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Academic Discipline, Mentoring, and the Career Commitment of Women Faculty.

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ACADEMIC DISCIPLINE, MENTORING, AND THE CAREER COMMITMENT OF WOMEN FACULTY

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ABSTRACT

Women continue to be underrepresented as faculty at U.S. universities, especially in the physical sciences and engineering. The belief that only women can adequately serve as role models and mentors for other women may be a roadblock to progress for women in disciplines where they are underrepresented. This study of women faculty investigates how female career commitment is influenced by academic discipline and mentoring. The survey responses of sixty-six tenure-track women faculty were used to obtain data for both science or engineering and non-science or engineering academic disciplines at three public Ph.D. granting research universities. The women faculty in science or engineering departments, where women are in the minority, scored higher on a measure of career commitment than women employed in departments which already have a critical mass of women faculty. Women reported that mentoring was important to their advancement in non-traditional academic careers. Women who had been mentored by women did not have higher career commitment scores than women who had been mentored by men. In some instances, women who had been mentored by men had higher career commitment scores. Interviews revealed that the concept of mentoring is problematic for female and male academics. Supportive, skill development, promotion, and guidance mentoring behaviors were identified as being helpful to female academic career advancement. Women faculty in science or engineering reported wanting more acceptance, more respect, and more women faculty colleagues. Women faculty in non-science or engineering disciplines reported wanting more compensation and more support for travel and research.

CHAPTER 1
INTRODUCTION

Background

Women became a majority of college students for the first time in U.S. history in 1979 (Touchton, 1991:3). They earned more than 58% of the associate degrees, and more than 54% of the bachelor's degrees conferred in 1991-1992 (Almanac, 1994:31). However, of the 39,754 doctoral degrees conferred in 1993, only 38% went to women. In 1993, women earned a respectable 41.7% of the doctorates in life sciences, but only 20.7% of the doctorates in the physical sciences, and a mere 9.1% of the doctorates in engineering (Almanac, 1994:16). Women represent a slight majority when entering college, but they are earning far less than a representative share of the doctorates, especially in the physical sciences and engineering.

Women continue to be seriously underrepresented on the faculty of our research universities. In 1987, women held only 27% of all the full time post secondary faculty positions in the U.S., and women were only 18% of the faculty at Big Ten and Ivy League schools (Farley, 1990:199). Women faculty with tenure were only 9.3% of the total faculty at public Ph.D. granting universities in 1985, and less than 8% of the total faculty at private Ph.D. universities (Touchton, 1991:90). If the rate of progress since 1975 continues, Alpert (1989) predicts it could take women faculty as much as 90 years to reach parity at Ph.D. granting universities in the United States. There is no consensus in the literature that parity for women is realistic. Rather, a critical mass is most often identified as the desired and achievable goal. The continuing underrepresentation of women as university faculty, especially in the physical sciences and engineering, is the impetus for this study.

Problem Statement

In the past, there have been discriminatory practices which have kept women from participating in certain male dominated professions. Discrimination has become illegal, so why are women still underrepresented on the faculties of our universities, especially in the physical sciences and engineering?

Women are well represented in the disciplines of nursing, home economics, early childhood and elementary education, which have their higher education roots in colleges for women. Have women succeeded in these disciplines because they have more career commitment to disciplines where females have a majority role? What influence does academic discipline have on the career commitment of women faculty?

Sponsorship or mentoring is considered to be important to the success or failure of an academic career, especially for women. Because some academic disciplines are dominated by females, does that mean the women in those disciplines are receiving more mentoring from other women? Are women in science and engineering getting less mentoring than women faculty in other disciplines? Does mentoring influence the career commitment of women faculty? Do women faculty have more career commitment if they are mentored by men, or by women?

What other factors affect the career commitment of women faculty? Are women faculty "turned off" by the supposedly more competitive and less supportive environments associated with the physical sciences and engineering? Do some academic disciplines offer women more opportunities for career advancement than others? Are there work related incidents which can cause women scientists and engineers to abandon their aspirations for non-traditional careers? What factors are uniquely associated with different disciplines that may make the work environment more or less inviting for women?

A "pipeline problem" has been identified in education which leads to a lack of women and minorities in science and engineering (Berryman, 1983; Oakes, 1990). There are important reasons to be concerned about this pipeline problem says Bernadine Healy (1992), former Director of the National Institutes of Health. A 36% increase in the need for scientists and engineers is being predicted by the end of this century (National Research Council, 1991) and a future supply of new scientists and engineers is seen as essential to maintaining U.S. competitiveness in the global economy. The young women and minority students who have entered high school since 1992 can provide a major new source of future scientists and engineers to meet national needs in the year 2000 and beyond.

The educational pipeline for scientists and engineers begins with enrollment in introductory high school courses in math and science. The number of students continuing in these courses declines rapidly as they move through the pipeline to complete high school, go on to college, and enter and complete graduate school. The participation of women and minorities in the science pipeline declines more rapidly than that of white males, leaving only a small percentage of females with graduate degrees in science and engineering to exit the educational system. According to Walter Massey

(1992), former National Science Foundation Director, there is "...an illusion that only 'the best and the brightest' can do science. Coursework is viewed by many faculty as a way to separate the 'men' from the 'boys.' Unfortunately, these courses also tend to separate the men from the women..." (p. 1178-1179).

The student pipeline problem continues as a faculty pipeline problem for women faculty in the traditionally male academic disciplines of higher education. For example, in 1989, women comprised only about 11% of the science faculty in the U.S. (Sloat, 1990). In 1989, women Ph.D.s were only 17.5% of all U.S. science and engineering faculty (National Research Council, 1991:24). This means that women were only about 6% of the engineering faculty in the U.S. in 1989. And, "while men Ph.D.s are more likely to hold full or associate professorships, women are much more likely to be instructors, lecturers, adjunct faculty..." (National Research Council, 1991:24).

There have been claims that appropriate role models are needed in education, to affect the pipeline problem and achieve more equitable results for women and minorities (Bronstein, Rothblum & Solomon, 1993; Klein, 1985; Fields, 1981). It is also claimed that female and minority participation could be enhanced if university science and engineering faculty were more representative of these populations. There are numerous examples of improved results from the colleges for women and minorities, where faculty have been more representative of women and minority students (Pearson, 1989). Healy (1992) says "...all women's colleges lose fewer of their science majors to other fields" (p. B5).

There is, in fact, a two-tier pipeline problem in the predominately white male physical science and engineering disciplines in higher education. Women and minorities have had a problem getting through the undergraduate and graduate school pipeline in science and engineering, and they have also had a problem getting through the faculty pipeline to tenured positions. Since the typical science and engineering faculty was 82.5% male in 1989 (National Research Council, 1991), it is argued that the willingness and ability of this traditional faculty to recognize the pipeline problem, to recruit, encourage, and retain other race and women students in science and engineering, is compromised by the majority position held by males (Harding, 1991).

Healy (1992) reports that "a study by the American Association for the Advancement of Science found that women in science classes are subject to more negative treatment than their male colleagues--by both faculty and other students" (p. B5). Negative treatment has also been reported by women in engineering (McIlwee, 1992). This "negative treatment" in the past, or the expectation of negative treatment, may be the justification behind what appears to be a preponderance of expectation in higher education that women should act as role models and mentors for other women (Byrne, 1993; Bronstein, Rothblum & Solomon, 1993), even in disciplines where, traditionally, there has been a shortage of women to function in this capacity.

Byrne (1993) suggests that the practice of expecting and using only same gender role models to enhance female participation, though a popular and commonly held strategy, may be an erroneous approach which has actually delayed and even sabotaged the progression of females and minorities through the academic pipeline for the physical sciences and engineering. There simply are not enough women in senior level positions in the physical sciences and engineering disciplines to be the role models and provide the mentoring that women need to achieve parity in higher education careers.

Purpose of Study

The purpose of this research was to learn how female career commitment within the professorate is influenced by academic discipline and mentoring, and to attempt to identify other factors which may influence the career commitment of women college and university faculty.

Zuckerman (1992) says that one of the major explanations proposed for gender differences in career attainment in science and engineering is that there are gender differences in career commitment. According to this explanation, females are underrepresented as faculty in science and engineering disciplines because they may not be as committed to science and engineering careers as males. Zuckerman also notes that there are little or no data on the career commitment of women scientists and engineers holding doctoral degrees. She says that so little is known about the career commitment of women scientists that this is a thoroughly uncharted area for research (p. 55). Therefore, one important purpose of this research is to collect data on the career commitment of women faculty, both in the academic disciplines where they have been numerically successful, and in those disciplines where they are underrepresented.

Research conducted by Perry (1970) and Vaillant (1977) found that men, in general, are committed to self and career. Belenky, et al (1986), found career commitment to be quite different for women because, in general, women act more out of feelings of responsibility for others, and their commitment to work is mitigated by their consideration of the effect that commitment will have on others. For Vaillant's men, commitment to career was a linear quest, a singular imperative of life. For Belenky's women, life was more complex. It was a simultaneous balancing act of family, career, and many other commitments. Women did not put other aspects of life aside in order to focus solely on the career piece of their lives as men did.

Hoy and Miskel (1987) say educators' commitment to career can be determined by measuring their central life interests (CLI) in work. Research evidence suggests that the central life interests of educators are not exclusively in their work (Lortie, 1975). This is because an education career is predictable. Careers in education provide few opportunities for promotion and they do not provide extensive, unimpeded opportunities for rewards. These opportunities for promotion and rewards are requisite for high central life interests in work role commitment.

In the field of career development, Super's (1990) Life Span Theory maintains that advancing in career requires a high level of commitment to one's work. Super also points out how "key figures" (like mentors) affect exploration, information gathering, interests, self-concept, decision making in career determination, commitment, and advancement.

Prior to conducting this research with women faculty, preliminary interviews were conducted at research universities with two male department chairs, a male associate dean, a male dean, and a male associate provost. These administrators were all in academic disciplines where males represent the majority as faculty. All of the men were asked to talk about their experience with mentoring in higher education.

One of the men interviewed was an African American scientist whose career path had been from industry to academia. He had moved up through the faculty ranks into administration. He recalled a professor he had as an undergraduate, a white man who kept track of him and continually asked him how things were going. This "mentor" actually went to other faculty and interceded on his behalf if things went badly. The administrator was quite sure he could not have made it without that mentor's taking him "under his wing" the way he had, as it was difficult for him to be the only black man in his classes.

One department head, a white male, was asked if he had been mentored as an incoming junior faculty member, and if so, what that mentoring had been like. He responded that when he was newly hired by the university, he identified two obviously successful senior faculty members and then he watched them closely and patterned his own behavior and performance of duties to resemble theirs. When Byrne's (1993) definition of the difference between mentors (who play an active role) and role models (who play a passive role) was shared with this administrator, he reconsidered and changed his explanation. He said that he had used the two senior faculty as role models, not mentors, and he did not recall having been mentored as a junior faculty member. This confusion between role models and mentors agrees with what has been reported by Byrne.

The department head thought the university would be wise to foster mentoring by establishing annual awards at the college and the departmental level. These awards could include monetary incentives funded by the cost savings from reduced turn-over among junior faculty. Only newly tenured faculty could nominate their mentor(s) for the awards.

A second department head, also a white male, said he hesitated to even use the word "mentoring," because he thought too much gets classified as mentoring. For him, the typical science professor and graduate student relationship is not mentoring. In these relationships, the professor uses the student to work in the lab and collect data. The professor benefits from the graduate student's work, and that is not mentoring. He thought that real mentoring is not done for the self benefit of the mentor, as it is in a faculty/graduate student laboratory relationship. True mentoring was not to benefit the professor, but to make a contribution to the community. He noted that new faculty in his department are usually hired in expertise areas which complement the expertise already available within the department, and not to duplicate it. Therefore, new faculty come into the department as the "experts" in their specific research area and those new faculty usually know more in that specific area than do older and more senior faculty. In those cases, the senior faculty do not mentor junior faculty members in their research expertise area, because it is the junior person who is the authority. However, the senior faculty can and do mentor, or advise, the junior person regarding where to look for research funding, where to submit papers for publication, how to get tenured in their college, etc. He also said that no administrator could just tell him or other senior faculty to mentor and it would happen. He thought edicts from above were counter productive. He said that junior faculty who came to him for mentoring had to convince him of their commitment; otherwise, he thought he would be wasting his time if he mentored someone who was not committed.

An associate dean said that he had been mentored as a graduate student by a professor who was consistently supportive, and suggested topics for research, and pointed out possibilities for funding and publication. Although this professor had not been his major professor, the professor was instrumental in showing him how to be successful in academia, and this experience had strengthened his self-confidence and resolve. This administrator thought mentoring was important in order to accomplish diversity within his college. He saw mentoring as something senior faculty do to introduce junior faculty to the college environment, to show them how it works and to encourage them so they can succeed and advance in their academic careers. He thought that both university and college level mandates for senior faculty to mentor junior faculty could be effective with information, training, and an agreed upon mentoring plan which the faculty mentors have helped to develop.

The dean who was interviewed reported that he and the faculty in his college have concerns about mentoring. His faculty tell him they fear sex or race discrimination charges if they do not mentor women and minorities. They are also concerned about what would happen if they do mentor women or minorities, and for some reason it does not work out. In fact, the whole issue of sexual harassment has them worried. It seems to have evolved, in practice, into "the male is presumed to be guilty." Most university policies and procedures are rigidly adhered to, little is done to protect the charged, and before misunderstandings or facts can be sorted out, a distinguished career, reputation, or personal life, can be devastated. The legal risks just seem to be overwhelmingly prohibitive to individual male faculty members. Faculty efforts to offer and provide mentoring could be misinterpreted, and "they are afraid to risk it." He thought this context of fear was inhibiting male mentoring of women and minorities within his discipline.

This dean said that getting his faculty to see mentoring as an opportunity is problematic. Men faculty who successfully mentor women are often the subject of negative gossip within his college. "People assume that there must be something going on between them when they spend time together." There is no visible or universally accepted structure to mentoring such that it can be easily recognized or evaluated. Students and junior faculty members may not be self-confident enough to ask for mentoring, or to recognize what it is when it is being offered.

These early interviews with male administrators point out that even though mentoring is identified as taking place in higher education, the concept is problematic. There has been little or no formalization of mentoring to make it easily recognizable, even for men. Mentoring is thought to be valuable to an academic career, but some men are fearful about providing this kind of support for women co-workers. Therefore, even though the literature identifies mentoring as important to the success of women in non-traditional careers, it is possible that women faculty in predominantly male disciplines within higher education are not recognizing, asking for, or receiving mentoring. Whitt (1991) found that new faculty actually fear taking the initiative in asking for help, and thus they experience feelings of isolation and deprivation.

The work of Byrne (1993) supports the importance of mentors to career advancement in non-traditional disciplines, and Byrne, Harding (1991) and Tobias (1994) point to the need for a "critical mass" of women to change the environment of science and engineering so these disciplines are more inclusive, and thus more attractive to women as a career.

Research Hypotheses

Women have been successful and have achieved a critical mass as faculty in the traditionally female academic disciplines of higher education, i.e. nursing, home economics, elementary and early childhood education, social work, etc. Women continue to be underrepresented as faculty in the physical sciences and engineering. It could be argued that women would have to have more career commitment to succeed as faculty in the sciences and engineering, where they are a minority. However, the literature associates career success with career commitment. Women have been more successful in the academic disciplines where women are in the majority as faculty. Women continue to be underrepresented as faculty in science and engineering. Therefore, if career success is associated with career commitment, it might be argued that women have been more successful in the traditionally female academic disciplines because they have more commitment to careers in those disciplines.

Whether there is any difference in career commitment, between women faculty in female dominated disciplines like home economics and women faculty in science or engineering, is unknown. However, for women to aspire to non-traditional careers as university faculty, in departments where they are often the only woman, requires a great deal of commitment on their part. Therefore, in spite of the numerical lack of women faculty in the physical sciences and engineering, and the shortage of other women to serve as their role models and mentors, it is suggested that the career commitment of women science and engineering faculty must be even greater than the commitment of women who choose careers in the more traditionally female academic disciplines.

Mentoring is identified in the literature as being crucial to the success of women faculty in academic disciplines where women are underrepresented, and it has also been noted that males do not see mentoring, especially across gender, as being part of their role as faculty (Byrne, 1993). Since science and engineering faculty are predominantly male, it was expected that women faculty in science or engineering disciplines would have fewer opportunities for mentoring, and this might be a contributing factor in their being underrepresented in those disciplines. In the more traditionally female disciplines, there are more women faculty available for same gender mentoring. It could be argued that women have been more successful in careers in the traditionally female academic disciplines because there have been more opportunities for same gender mentoring in those disciplines.

To determine the influence of academic discipline and mentoring on the career commitment of women faculty in higher education, this study compares the scores of women faculty on a career commitment (central life interests in work) measurement instrument. Survey responses and interview data of women faculty are also compared in order to develop hypotheses for the question, "Why are women underrepresented as faculty, especially in the traditionally male science and engineering disciplines?"

The primary hypotheses for this study are:

1. Women faculty in science or engineering disciplines, where women are a minority, will score significantly higher on a measure of career commitment than women faculty in non-science or engineering disciplines, which have a critical mass of women faculty.
2. Women faculty who have been mentored will score significantly higher on a measure of career commitment than women faculty who have not been mentored.

In addition, secondary hypotheses are considered in an attempt to identify additional variables which may impact upon the career commitment and advancement of women faculty in higher education (see Table 3.2). Variables identified for testing in the secondary hypotheses include the opportunity for career advancement, the competitive or supportive nature of the departmental work environment, the impact of work related incidents, and what the women faculty reported that they would change about their jobs if they could.

Definition of Terms

The key constructs used for this study have meanings which were dictated by their common usage within higher education and the extant literature in the research field. These constructs are defined as follows:

Academic Discipline - Academic discipline can be both field of study and a departmental unit within higher education. For example, chemistry and nursing are fields of study and also departmental administrative units at most universities. In this study, women faculty were asked to report their academic department for the purpose of identifying their employment within either science and engineering, or non-science and engineering.

Career Commitment - Career or work role commitment is an expressed interest in, preference for, and focus on work oriented behaviors. For this study, career commitment was identified by using the Miskel, Glasnapp and Hatley (1975) measure of central life interests in work.

Central Life Interest - Central or principal life interest is the focal arena of an individual's preference for behaving in a given setting or environment (Dubin and Goldman, 1972; Dubin and Champous, 1977). Although the individuals in this study may have central life interests outside of their work, their other interests are not included in this study since the purpose here is to determine women faculty's central life interests in work.

Critical Career Incident - For this study, a critical career incident is a significant positive or negative experience, recalled and reported by a woman faculty, which has impacted upon that individual's career. Cole and Singer (1991), Whitt (1991), Boice (1993) and others, have identified these incidents or experiences using a number of different terms.

Critical Mass - Critical mass is a minimum percentage of women faculty necessary in a department or discipline such that women are no longer abnormal, atypical, or non-traditional in that setting. Using Byrne's (1993) definition, an academic discipline or department is non-traditional for women if women represent less than approximately one-third of the faculty. If women represent 30% or more, then the discipline or department has reached a critical mass, and is considered to be gender-neutral. In this study, women were asked to report how many total faculty and female faculty were employed within their department, in order to determine the presence or absence of critical mass.

Departmental Competitiveness - For this study, departmental competitiveness is an evaluation made by a woman faculty of the level of competitive behavior she experiences within her departmental work environment. Women faculty were asked to respond to questions which identified their department as being either competitive, or cooperative and supportive.

Departmental Supportiveness - For this study, departmental supportiveness is an evaluation made by a woman faculty of the level of supportive behavior she experiences within her departmental work environment. Women faculty were asked to respond to questions which identified their department as being either competitive, or cooperative and supportive.

Measure of Career Commitment - For this study, career commitment was identified by using a central life interests in work role measurement instrument for educators (Miskel, Glasnapp & Hatley, 1975).

Mentor - A mentor is someone who has been helpful to a respondent's academic career by providing advice, encouragement, funding, introductions, the teaching of rules, or other supportive behaviors.

Mentoring - For this study, mentoring is helpful behavior provided by others in support of a woman's academic career. To identify mentoring, women faculty were asked to recall and report these helpful behaviors.

Non-science or Engineering - For this study, non-science or engineering are the academic departments outside of science and engineering in which women represent 30% or more of the faculty. The non-science or engineering disciplines which were represented in this study included art, child development, consumer sciences, communication disorders, education studies, English, family studies, human ecology, library science, nursing, nutrition, sociology, and textiles.

Opportunity for Advancement - For this study, opportunity for advancement is an evaluation made by women faculty of the opportunity for their promotion and career advancement within the departmental work environment.

Science and Engineering - For this study, science and engineering are the academic departments of science or engineering in which women are less than 30% of the faculty. The science and engineering disciplines which were represented in this study included aeronautical engineering, biochemistry/chemistry, biology/microbiology, botany, chemical engineering, computer science, ecology, agricultural economics, electrical engineering, food science, geology/geoscience, mathematics, mechanical engineering, and physics.

The references noted for these constructs are discussed in greater detail as part of the literature review in Chapter 2. Some of the constructs defined here are discussed again, as research variables, in Chapter 3.

Rationale and Organization of Study

Women have advanced successfully in some faculty careers, and they represent a critical mass in some academic disciplines. It could be argued that women have been more successful as faculty in historically female academic disciplines, like nursing or home economics, because they have more commitment to those traditionally female careers. However, as Zuckerman (1992) has pointed out, there have been little or no data available on the career commitment of women in science or engineering with which to support or refute this. One goal of this study is the collection of career commitment data for women faculty in science and engineering.

The social sciences literature which addresses the underrepresentation of women in science and engineering points to potential causes as being either internal to the women themselves, or external to women and part of the environment (Sonnert and Holton, 1995). Commitment to career may be identified as an internal factor. If there are differences in commitment, then those differences may also be identified as factors which are internal to women, but the differences may be due to external causes such as the lack of opportunity for female career advancement within specific environments.

There are many external factors besides the presence or absence of advancement opportunities which may impact upon career commitment. For example, mentoring is an external influence which is thought to impact upon the internal career commitment of women faculty. Another goal of this study is the identification of other external factors which women faculty identify as affecting their academic careers.

In Chapter 2, the literature review for this study includes the areas associated with careers and higher education,--the literature of career development, education, and also economics. Some representative theories are presented from each area for their contribution to the discussion of career choice and commitment factors.

The career development literature includes numerous theories which attempt to explain work role and career choice. Although there are many well-respected theories in this area, the majority of the theories have been developed by studying the career development and advancement experiences of males. Though these theories are interesting and worthy of consideration, their applicability to the career experiences of women is unproven.

Economics is a natural part of career considerations, yet women do not appear to be solely market driven when making career choices. Though economics appears to play an important role in the careers of women faculty, there are also non-economic factors which have an impact and may even keep women from choosing and persisting in higher paying careers as faculty in science and engineering.

In the higher education literature, the problem of the underrepresentation of women as faculty in the physical sciences and engineering is well acknowledged, but there seems to be little consensus on how to remedy the situation.

The roles of mentoring, work role commitment, and critical incidents in career advancement are also discussed in Chapter 2, to introduce and explain the concepts, and to present an overview and summary of the literature which generated the hypotheses for this study.

Chapter 3 describes the design for the study, presents the hypotheses, explains the variables and measures, identifies the sample which was drawn from three research universities, presents the distributions of scores from the survey instruments, and discusses the data analyses used in testing the hypotheses for this research.

Chapter 4 presents the research findings for each primary hypothesis, and for the secondary hypotheses, and the results from interviews which were conducted with women faculty.

Finally, in Chapter 5 the problem and method are summarized, and the findings from this research project are interpreted. The limitations and implications of the study are also discussed.

CHAPTER 2
REVIEW OF LITERATURE AND DISCUSSION

Women continue to be underrepresented as university faculty in physical sciences and engineering disciplines. The primary purpose of this research was to learn how the career commitment of women faculty is influenced by their academic discipline and the mentoring they receive. A secondary purpose of this research was to identify other factors which may influence the career commitment of women faculty.

The literature review for this study included the fields of career development, economics, and education. Education literature identifies the problem of female underrepresentation in faculty careers. Career development literature contributes numerous explanations for the development of career interests, choice, and persistence. Mentoring and critical incidents are identified as factors in the persistence and advancement of women in non-traditional careers, and both are discussed within the literature of education and career development. Economic theory explains incentives and constraints associated with working and career advancement. Each area of the literature addresses some aspect of the underrepresentation of women as university faculty, and together they provide an overview of the complexity of the problem.

The literature review for this study was influenced by numerous presentations, books, papers, and studies on the topic, many of which are listed as references. It was organized to show that the underrepresentation of women in science and engineering does not begin with higher education. Early career development issues are presented first. These are followed by the economic considerations associated with career choice. Finally, the resulting problem within higher education is presented and this is followed by discussions of mentoring and critical incidents as factors in non-traditional career persistence and advancement.

Career Development

In considering the underrepresentation of women in non-traditional faculty careers, theories of career development are a logical and interesting place to start because they provide explanations for the career choices made by people. One of the most noted, Life Span Theory, explains how an individual's career interests develop and change from birth through retirement. A long time frame is involved, and emphasis is given to identifying the career related stages people go through during their lives.

Super's (1990) Life Span Theory identifies six roles a person may fill in life. These roles are identified as child, student, leisure, citizen, worker, and homemaker; they vary in importance depending on the person's age and life stage. For children, school and leisure (or play) are major factors. As people age, the roles of citizen, worker and homemaker become more developed. Each role occupies more or less of a person's life at different times. Work may stop at 65, homemaker may begin early or late, citizen and leisure roles may vary in importance, some have chosen to be students all their lives, etc.

Since people differ in how much importance they assign to a role, this can be a factor in their commitment to the role of career. Work can have very different levels of significance to a person at different times in her life. Super identifies commitment, participation, value expectations, and knowledge of roles as salience factors of life role.

If women have no knowledge of non-traditional careers, little value will be seen in them, there will be little commitment, and little participation.

Super identifies six "life stages." These are birth, growth, exploration, establishment, maintenance and disengagement. Each stage has substages. In general, the life stages progress as follows: During the growth stage, children have curiosity and fantasize, and they develop interests and capacities. At about 18 years of age, the exploration stage begins. In this stage, young adults crystallize and specify what they want to do, and begin to implement a career choice. By about the age of 30, adults enter the establishment stage. They stabilize in their occupations, consolidate (which means become comfortable), and are advancing. The maintenance stage begins at about 45, and in this stage the adult worker is holding on to career, updating knowledge, and innovating. Finally, the disengagement stage begins at about 60 with decelerating interest in career, followed by retirement planning and then retirement living. Super notes that these stages can occur at other ages and uses the concept of "recycling" to denote that individuals who wish to make a career change may be in career establishment or maintenance stages and return, or recycle, to the exploration stage for additional information about other options.

Super has a model to show how curiosity, exploration, key figures (like mentors), information, interests, self-concept, and other factors lead to planning and career decision making. The young child is naturally curious and curiosity leads to exploration. If, in exploration, the child experiences conflict, then there will be withdrawal. Without conflict, the exploration leads to information and key figures.

From these come interests and a developing sense of internal and external control. In early adolescence children begin to develop a time perspective and their self-concept. When sense of self is developed, then comes the ability to plan and problem solving/decision making about careers takes place. Super says that career planning, career exploration, decision making, world-of-work information, and knowledge of preferred occupational group determine a person's career attitudes, knowledge and skill in career selection.

Life Span Theory identifies stages of human development which lead to career choice and career maturity. It also provides a useful template for describing and exploring exceptions. For example, in career exploration in childhood, if girls see no (or too few) key figures or receive no encouragement to enter into non-traditional careers, this can be interpreted as a "conflict," which Super says can cause them to withdraw from developing an interest in that career. If a woman experiences discrimination or sexual harassment in the establishment stage of her career, this can also be interpreted as a "conflict," and she may "recycle" back to the exploration stage to change her career. If a woman sees no women in a role, she may assign diminished importance to that role and not participate in a career she is otherwise capable of pursuing.

The underrepresentation of women faculty in science and engineering in higher education would suggest that women are not progressing to the advancing substage of Super's establishment life stage in those careers. Women are beginning careers in higher education, attempting to stabilize and become comfortable; but they are not advancing in equitable numbers in tenured faculty positions in the disciplines which are non-traditional for females.

In 1957, Super proposed seven career patterns for women, but that model is no longer considered appropriate. In fact, many have criticized Super's Life Span Theory as not being applicable to women. And yet, according to Sharf (1992), "most of the information about career development of women has come from life-span theory... It is life-span theory that draws attention to sex role issues that affect career development in childhood, adolescence, and adulthood" (p. 373).

In addition to Super's theories, there are other life span theories which, though not as comprehensive as Super's, also contribute to understanding career development. For example, Gottfredson (1981) says that both sex role and social class work to limit career choice. She predicts that as children grow older, modification of career plans will occur to resist compromising social class and traditional sex-role orientations.

Bardwick (1980) sees women of 40 to 50 becoming more independent and autonomous. It is a time when children have been raised, and the women who gave up careers to have children can now return to work. Because of this, Bardwick sees women's stages as being different than those proposed by Super. Women are advancing in their careers after 50 instead of being in a maintenance stage. This theory is unique because it acknowledges marriage and family as important factors in the career decision making of women.

According to social learning theory (Mitchell & Krumboltz, 1990), role models are important career development learning experiences for women. Women who have learned about other women pursuing non-traditional careers are more likely to choose non-traditional careers for themselves. The exploration of non-traditional career opportunities is enhanced through exposure to female role models with whom women can identify, and from whom they can learn to reject stereotypes.

Accident theory is an early sociological approach (Bandura, 1982), which says we make our career decisions due to opportunities that happen by chance. Our decisions are influenced by a teacher, a volunteer, an event, or a job that becomes available due to some unpredictable occurrence. According to this theory, chance factors have a bigger influence on occupational choice than planning.

Rosenbaum (1989) suggests a tournament theory which describes career development in organizations. Imagine a diagram for a tournament where only the winners from each round advance to the next level. This seems especially applicable to higher education, where failure to be promoted to a tenured position limits future possibilities in that tournament. To continue when advancement does not occur, the individual must withdraw and go to another tournament (or university) to compete. Rosenbaum says that tournament models are more likely to occur in large organizations where people must compete for positions.

Some theorists have looked at how an occupation can affect the worker. Kohn and Schooler (1978) theorized, studied, and found that working in an unchallenging job can actually diminish the worker's intellectual skill. This should be an important consideration in career choice. Ogbu's (1989) theory regarding the career development of African Americans says that perception of a job ceiling causes reduced value in education. School is seen as a threat to societal role identity and security, and not as a way to advance.

It is disappointing that many of the career development theories have been developed overlooking the experience of women. Except for limited contributions by Gottfredson, Mitchell & Krumboltz, Super, and Bardwick, there is little attempt to explain differences in the development of women's careers. Women are affected by many unique experiences which can impact upon their career choices, preparation, and participation. Marriage, family, and child rearing responsibilities, sex discrimination, sexual harassment, socialization and gender-role stereotyping, interrupted work patterns, glass ceilings, a shortage of non-traditional role models and mentors, unchallenging jobs and intellectual decline, lower wages, and more, are identified in the literature (Halpern, 1992). Women who attempt to become science or engineering faculty may be facing these challenges to their careers, plus other difficulties associated with the predominantly male environment of higher education.

Economics

It is customary to associate economics with labor markets and careers. In our market economy, most careers include salaries which are part of the gross national product. Free or low cost public education has been provided in the U.S. in the belief that education produces more economic and social benefits for all individuals, male and female, and society in general. This view is supported by the human capital (HC) theory which says investment in education leads to increased productivity, which leads to better jobs and higher earnings (Cohn & Geske, 1990). Weaknesses of the human capital approach have been pointed out by Blaug (1976), who finds the theory fails to explain why people choose occupations which do not lead to higher earnings, and it fails "to provide a testable theory of occupational choice" (p. 839). For example, when educated women select traditional and lower paying careers, this is an example of the weakness Blaug has identified in the HC theory.

On average, people with more education will earn more. In 1979 female school dropouts were 48.4% employed, high school graduates were 78.8% employed, women with 1-3 years of college were 83.9% employed, and college graduates were 93.4% employed (Dearman & Plisko, 1981). The employment of females steadily increases with increases in their level of education. And even though women have traditionally earned less than what comparably educated men have earned, women with more education do, on the average, earn more than women with less education. According to Mickelson (1989), "...year for year and credential for credential, both men and women receive more returns on more education but they start in different places in the opportunity structure" (p. 52). Women see their investment in education as rewarded because they compare themselves to other women, and not men. Mickelson argues "women's evaluations of whether returns on schooling are equitable are based on their awareness that there are two occupational structures, one for them and one for men" (p. 52).

A labor market segmentation or "dual theory" (Doeringer & Piore, 1975) has been proposed which says there are two labor markets, a primary and a secondary, and unlike the HC theory, only those who make it into the primary market will receive higher earnings. Individuals in the primary market are rewarded for investing in education. For those in the secondary market, there is no relationship between education (or credentials) and income. This dual theory offers a possible explanation for why the occupations traditionally held by women, which could be classified as secondary labor market occupations, are paid less than those in the primary market. However, even if the dual theory were adopted to identify constraints to labor market forces working for women, the dual theory does not completely explain why some women select lower paying traditional women's careers rather than higher paying non-traditional careers. Wilson and Boldizar (1990) point out that women are "overrepresented in the fields that yield the most modest economic rewards" (p. 62). Their research found that women continue to aspire to traditionally female careers which have lower income potential.

Mickelson (1989) found that "even though women have all but closed the overall gap in educational attainment between the sexes, ...men and women continue to work in sex-segregated labor markets that have different career ladders" (p. 51). In higher education, Ransom (1990) found that even though traditionally male fields have opened up to women, "a broader view of segregation" does not show improvement because the "increased representation of women in male fields has been offset by the growth of traditionally female fields, particularly nursing" (p. 490).

Although more women are entering and graduating from higher education institutions, women continue to major in, aspire to, and be employed in fields traditionally held by females, lower paying fields than occupations traditionally held by males. Since women and minorities are getting more education and still not choosing careers in the physical sciences and engineering in representative numbers, it appears there are other factors which can impact upon career choice as much or even more than the prospect of higher earnings.

For example, Holland and Eisenhart (1990) studied women undergraduates at two colleges to determine why women are entering but not persisting in science majors. They identified a complex set of behaviors and "games" played by college women. Their research found that the commitment and persistence of college women majoring in science was being undermined by their participation in the games played by their peers. The more involved the women became with peer games and romance, the more they marginalized their studies and sacrificed their goals for science careers.

There may be environmental factors associated with science and engineering which make them less desirable as a career choice for women. The former National Institutes of Health Director, Bernadine Healy (1992), reported that studies show fewer females than males choose careers in science, and she says:

> In view of some negative treatment in the classroom and discouraging employment...prospects, the astonishing thing is that young women pursue careers in science...at all! But it is fortunate -and important -for our country that they do. By the year 2000, women and minorities will account for 68 per cent of the new workers... If we are to ensure our country's future competitiveness, we must change the prevailing culture - the rules of the game -in our classrooms, boardrooms, laboratories, and faculty lounges. To do so, we must recognize that brain, not brawn, will dominate the next century, and that means more than ever we must tap into the brain power of women...(p. B5)

Education influences career choice (Quinn and de Mandilovitch, 1975), yet the climate of instruction for females is such that women generally do not see themselves reflected in the present models of physical science and engineering careers. Women make up only 11% of the science faculty nationally, and only 15% of the science and engineering work force (Sloat, 1990). This low representation may contribute to stereotyping. Lack of knowledge about career options and fear of sexual harassment in non-traditional occupations are factors which may limit women's career choices (Women's Bureau, Dept. of Labor, 1990).

Mickelson (1989) says that for women, the returns from investment in education are considered not just in terms of income, but also through consideration of their family and community roles. Due to socialization, in general, women do not see individual self-interest as being as important as their roles in support of family and community. Mickelson says, "the underlying models of human capital theory and emerging feminist theory are different" (p. 60). Arguments which connect career choice solely with labor market forces must be broadened to account for the different experience of women within our culture.

The career choices of educated women continue to be made, in general, away from the higher paying and non-traditional physical sciences and engineering, and toward the lower paying more stereotypical gender roles for women. There may be powerful non-economic factors which influence career choice for females, function as constraints to the labor market, and cause women to select the more traditional occupations and careers in higher education which do not maximize their income.

Education

In the past, boards of educational institutions hired male administrators and faculty, who in turn sponsored other men into administrative positions. Through this tradition, the administration of our public educational institutions became predominately white and male. The advancement of more women into educational administration has been delayed by a "...level of hostility toward affirmative action by major federal institutions whose charge it is to encourage it..." (Richards, 1988:159). Progress has also been hampered by dissention over what would constitute fair representation. For example, some suggest that the percentage of women faculty should be representative of the female undergraduate enrollment. Even if this were to become a consensus goal, there is still the question of how affirmative action, which is designed for implementation during periods of growth in hiring, can be implemented during periods of reduced public financial support and reductions in force. The problem is compounded because women in higher education have selected and are clustered in traditional women's disciplines.

Ransom (1990) has studied gender segregation by field in higher education. He notes that just as occupations in society are segregated into "men's" and "women's" work, so, too, women on university faculties are segregated into traditional and predominantly women's fields. In fact, "...the representation of women on faculties has lagged behind levels of degree attainment" (p. 477). In reviewing national surveys of U.S. college and university faculty conducted in 1969, 1977, and 1984, Ransom found that faculty gender segregation declined between 1969 and 1977, but remained constant between 1977 and 1984. The total number of women in higher education went from about 20% in 1969, to about 27% in 1984. However, even though more women were entering traditionally male disciplines, growth in the number of females in traditionally female disciplines was even greater.

Doctoral degree data collected from 1975 to 1985 revealed that "education and health sciences show a strongly increasing predominance by women over the time period" (Ransom, 1990:487). In spite of the increase in women entering engineering and sciences, these disciplines have been growing, more men have entered them than women, and they continue to be predominately male. According to Ransom (1990):

> The number of women in nontraditional fields is still small... Between 1977 and 1984 there has been basically no change. Increased representation of women in male fields has been offset by the growth of traditionally female fields, particularly nursing...
>
> Analysis of doctoral degrees awarded in 1974-75 and 1984-85 showed that the overall level of segregation by field has actually increased, even though some traditionally 'male' and 'female' fields have become more integrated. ...women are now entering fields that were once closed to them, but the overall level of segregation by field has not decreased by much in recent years. (p. 489-490)

Wilson and Boldizar (1990) looked at gender distribution in undergraduate colleges between 1973 and 1983. They found that males became more concentrated in the "high-mathematics-achievement" fields, and women became more concentrated in the "low-mathematics-achievement" fields during the ten year period studied.

> The proportional representation by mathematics achievement moved towards greater relative gender specialization, with women concentrated even more into low-mathematics-achievement fields...a disquieting finding. (p. 72)

Wilson and Boldizar (1990) thought that gender segregation was declining because undergraduate female representation had grown 11% in both engineering and physical sciences between 1973 and 1983. In contrast, Ransom (1990) says gender segregation in graduate schools increased during this period because more men than women entered the male fields, and more women than men entered the female fields. Although several areas which were once restricted to men only have begun to integrate in recent years, his studies of segregation do not show clearly that there has been significant improvement.

Richards (1988) points to a serious deficiency when he comments that "Unfortunately, the poverty of theory attending most of the research on inequality and discrimination impedes policy prescription" (p.159). Though the underrepresentation of women and minorities in non-traditional disciplines and the administration of higher education can be documented, there is lack of consensus regarding how to proceed to ameliorate inequality.

It is thought that the underrepresentation of women in some disciplines, like engineering, is a function of the male identity of that working environment (McIlwee & Robinson, 1992). This means that the environment, because it has been composed of all males for so long, has taken on a male identity which makes it unusual and abnormal for women, who enter engineering not looking or acting like a male, or how an engineer has traditionally looked and acted. Due to stereotypes, male (and female) expectations are that women are different and not quite as good (Klein, 1985). Eventually, the self confidence, commitment, and performance of these women are undermined by those unspoken expectations. McIlwee and Robinson (1992) found that women advanced more quickly and successfully in engineering careers if they entered new fields of engineering, where there was no tradition of the career being all male.

In new areas, women were able to perform their jobs with confidence, without being undermined by a male identity and environment for that occupation.

Sonnert and Holton (1995) say the social science explanations for the underrepresentation of women in science fit into two categories: There are explanations which promote a difference model, saying there are internal gender differences in behavior and attitudes. There are also explanations which promote a deficit model, identifying external structural impediments in the scientific environment. They suggest that the structural impediments and the behaviors-attitudes can interact to create a complex barrier for women pursuing a career in science in higher education.

Mentoring

There is increasing support for the argument that to get more women into science and engineering, more women role models are needed. Eileen Byrne (1993) calls this an outdated "blame the victim" approach. This belief in the need for role models has been a pervasive but unproven theory in society and higher education. It has been used to procrastinate, and it has also been used to place extraordinary demands on the few women science and engineering graduates who have become university faculty. Byrne's research challenges our not-working assumptions and points to workable new possibilities.

Using undergraduate enrollment of women in science as a measure of access to science in higher education, and completion of graduate school as a measure of persistence, Byrne studied the impact of the presence of women faculty role models on female access to, and persistence in, science in Australian higher education. She found no support for the theory that the presence of more female role models increases either female access or persistence in science and engineering. Byrne discredits our belief in the absence of same-sex role models as a cause for women's under-achievement in non-traditional areas. She says, "Policymakers, inservice trainers and field personnel have acquired an entrenched belief that the existence of more women role models would, automatically and by itself, increase female enrolments [sic] in the area represented by the female role models" (p. 93). However, because women do not yet represent a critical mass on the faculty of non-traditional science and engineering disciplines, they cannot be effective role models. As exceptions, they can accomplish little more than to break old stereotypes about women in these disciplines.

Byrne identifies the concept of "critical mass" as an important factor of influence on enrollment, persistence, and career decision making for women. She points out that there is little agreement internationally on how to determine if a discipline or career is traditional or not for women. However, in general, the U.S., Sweden and the U.K. cite an occupation as non-traditional if women represent less than about 1/3. What Byrne uses as a "Scale of Non-Traditionality," is that if women represent 30% or more of the enrollment or the teachers, the discipline is seen as sex-neutral. At 16-29%, the discipline is seen as untypical, but still sex-normal. At 9-15%, the discipline becomes abnormal for women. At 8% or less, the discipline is seen as abnormal and exceptional for women. In other words, women do not see women in that discipline as representative of women, and therefore, those women are not transferable as (role) models. Byrne says, "If a discipline is seen as untypical for girls to the point of sex-role abnormality, attitudinal barriers present a major hurdle to all but the very gifted, middle-class and/or confident" (p.12).

Young (1980) has noted that the "token woman" in the academic world "by virtue of talent and effort in measuring up to the high standards and superior attributes of academic men, is not only exceptional, but an exception to the social category 'women'" (p. 509). This form of tokenism is not effective with same sex students. However, Byrne says "the debate on female role modelling needs to shift from being seen as a process to influence girls' attitudes, to a strategy for altering boys' attitudes towards girls" (p. 92). Her point is that women in non-traditional areas can alter the attitudes of males, break stereotypes, and allow men to see women as capable in science and engineering disciplines.

Perhaps the most exciting of Byrne's points is the distinction between role modelling and mentorship. Role modelling, as described above, is passive and ineffective below the achievement of a critical mass. Mentoring "is an active process of positive sponsorship by older 'patrons' (teachers, managers, trainers, counsellors, more senior women staff, etc.) toward younger or less experienced entrants or trainees" (p. 97). She notes that "sponsorship, grants and the award of jobs are reflections of the power structure. In science and technology, women account for less than 2% of the top leadership. Mentors will, therefore, more often still be male" (p. 98). Byrne's review of research on role modelling found no empirical evidence to support role modelling as effective in increasing female enrollments. Rather, what Byrne found was that researchers who have espoused role modelling are actually describing "a series of mentor activities" (p. 99).

Byrne goes on to cite a number of studies which show that aspirations are influenced by supportive others of either sex. Since men are 98% of the top leadership in science and technology, it is most encouraging that the majority (men) can mentor women into non-traditional disciplines, and the minority (women) no longer have to be overwhelmingly burdened with role modelling responsibilities. "It should be recognized that most young women will more readily believe that they can achieve highly in disciplines when the men in those disciplines (staff and students alike) transmit the clear message that it is normal for women to do so; and not because women tell them so" (p. 123).

During her faculty interviews, Byrne found resistance among male faculty to acknowledge either the existence or the appropriateness of mentorship. One faculty member said it was his job to teach his disciplinary subject matter, not to engage in social engineering. "In analysing [sic] the interviews, we found that there was widespread agreement from Professors and Deans that active mentorship was not a role which the majority of their staff recognized or saw as their function" (p. 151).

Byrne says that for women who have successfully broken into non-traditional areas, there is "a common theme of the presence of a mentor, a sponsor, an enabler, a senior or leadership figure who has been more than a role model" (p. 133). She concludes, "We believe that mentorship is both a critical element of institutional ecology and a significant influence in women's retention and progression in non-traditional areas of study and employment" (p. 133).

What becomes obvious, according to Byrne, is that policies and practices for helping women can no longer be seen as just a women's affair. Any programs to increase the representation of women in science and engineering should now take into account the need for male faculty and administrators' responsibility for female mentoring. "Positive mentoring of able girls to help them to achieve equally in maths [sic], science and technical crafts cannot be a same-sex process because we do not yet have a critical mass of women teachers in these areas. Male teachers and lecturers need, therefore, to take responsibility not only actively to help women students to see achievement as normal for their sex, but also actively to teach men students that women are equally capable and have an equal right to scarce places in science and technology" (p. 160).

Sonnert and Holton (1995) studied a large sample of women and men faculty who had received post doctoral research fellowships from the National Science Foundation and the National Research Council. The women in their study reported that they had experienced less collaboration as an equal from their male senior colleagues than had their male peers. Women with male advisors reported that their male advisors had ignored them. However, the women with women advisors left science at a higher rate. It was thought that women become discouraged when they get to observe the difficulty of being a woman in science.

For women to enter and succeed in non-traditional science and engineering careers which are seen as abnormal for their sex, women may need to receive one-on-one advice, encouragement and support. To be effective, this empowering support which we call 'mentoring' may need to come not from the extraordinarily few women role models who are seen as exceptions, but from the majority who are in power and have credibility as being normal for that career, -the men.

Byrne's research has not accepted widely held but unproven role model claims which may have done little to facilitate and may, in fact, have impeded female advancement. Rather, her research challenged these widely held assumptions and found that both same and other-sex mentoring, not same-sex role modelling, can advance women in non-traditional careers.

Mentoring, given Byrne's view, becomes crucial to the career advancement of women. It may be argued that mentoring can make the difference between success or failure at entry, continuation, or advancement stages of career. And, since men are the majority and are seen as the norm in science and engineering careers in higher education, their advice and counsel is seen as coming from an authority, someone in power who has credibility.

Discussion

Super's (1990) Life Span Theory says that difference (success or failure) in career advancement can be associated with work role commitment. According to Super, some people are not as interested in work; their interests are primarily in other roles.

Therefore, they do not advance in their careers as readily as someone whose main focus is work.

Hoy and Miskel (1987) also associate career advancement with work role commitment. They discuss the importance of central life interests to career advancement, and they say that "for educators to have central life interests within the work setting, the situation must yield extensive unimpeded opportunities for rewards" (p. 406-407).

If women have not had high central life interests within a work setting in higher education, it may be because that work setting has not yielded unimpeded opportunities for their advancement. Higher education (and science and engineering within higher education) has been predominantly composed of males. Without some mechanism like mentoring, it probably would be difficult for women to see entering and advancing in science and engineering careers as a possibility.

Universities have had to meet affirmative action requirements and recruit women and minorities for faculty positions according to EEO guidelines. However, once hired, most new faculty, regardless of race or gender, are expected "to hit the ground running" (Whitt, 1991), and they have been left on their own, to "sink or swim" (Shepherd, 1993). This has been a standard practice in higher education. Significant effort is put into faculty recruitment, but usually little or no effort is put into retention. Just as coursework in science has been used to separate the men from the boys (and women), so has the promotion and tenure process.

This academic tradition may be a factor in pipeline failure. When the first or only woman or minority faculty member is not tenured and not retained, whether intended or not, this may send a discouraging message to students in the pipeline that those faculty somehow did not fit in or belong. Putting effort into faculty retention would be a break with tradition, one which could send a different and more encouraging message to students regarding the value associated with those faculty, and the possibility of the students' own future success in a non-traditional higher education career.

In higher education, especially in engineering and the sciences, competition and fairness are important rules of the male academic game (Boice, 1993). There is competition for scarce research funding, competition for publication in the journals, competition for teaching awards, leading to competition for tenure. The first women faculty in physics, petroleum engineering or soil science, if unfamiliar or uncomfortable with traditionally masculine forms of academic competition for grants or publication, may find it difficult to survive without considerable tangible and intangible start-up support (Coats, 1989; Gilligan, 1979; Halpern, 1992; and Shepherd, 1993). Women faculty say they care more about cooperation and affiliation than competition (Boice, 1993), and successful women faculty have stressed the importance of a supportive institutional environment (Davis & Astin, 1990). According to Boice (1993), "Exemplary [successful] women faculty came to campus with social network and mentoring in place. These new hires recognized that success had been prearranged for them" (p. 77).

It is common practice in higher education, especially in engineering and the sciences, that new faculty (especially women and minorities) are treated "no differently." They succeed or fail based on their ability to compete successfully. This is the policy "to be fair," and to avoid having new faculty resented by the other faculty with whom they must compete. However, the higher education environment in the physical sciences and engineering is composed predominantly of males. It has been argued that to support the first women and minorities "no differently," in a traditionally male environment, is to treat them quite differently (McIlwee, 1992).

Women and minority faculty members in science and engineering report that they are being treated differently, and not in a supportive way (Gainen and Boice, 1993). As a minority, they are frequently asked to serve on more committees than average (to be the desired or required minority member representative, and provide minority input), or recruit students, or teach special classes, advise student groups, serve as a role model and mentor, or to attend and give presentations at public events. If they decline to do some of these things, they risk being characterized as uncooperative or unwilling to contribute to the goals of the department or college. When they allow themselves to be used in this way, female faculty spread themselves thin and jeopardize their own professional credibility and chances for tenure.

O'Toole (1991) has reported that women in higher education find their institutions to be more supportive of women when there are fewer women in leadership positions. Male administrators in universities with token women administrators may think that having one very visible woman in administration satisfies the need for affirmative action university-wide. These beliefs may actually work against women who work at non-administrative levels in the institution. To compound the problem, token women in administration are more likely to adopt the stereotypical beliefs of the dominant group (Kanter, 1977), and they may begin to believe other women are not as qualified as men.

Critical Career Incidents

Cole and Singer (1991) have identified negative and positive career incidents or influences as "kicks." The kicks, and the individual's reaction to the kicks, can accumulate over time and contribute to, or detract from, the individual's commitment to a career. A negative kick from within the environment can be compensated for with a positive reaction by the individual, or made worse with a negative reaction by the individual. When a woman scientist is told by a male colleague that women are not good scientists, then that would be a negative "kick." If the woman responds to the kick by becoming discouraged and less committed, and this negatively impacts her research and career, then that would be a negative reaction to a negative kick. If the woman were to respond to her male colleague's comment by becoming more determined and committed, and doing the research which promotes her career, then that would be a positive reaction to a negative kick.

Boice (1993) also discusses the importance of negative career experiences, as crucial turning points and marker events, which can impact upon a woman's academic career early on and have a lasting detrimental impact. If a new woman faculty member feels isolated because her faculty colleagues act distant and are not helpful, her satisfaction and productivity can be negatively impacted upon (Corcoran and Clark, 1984; Clark and Corcoran, 1986). Whitt (1991) points out that new faculty members enter their academic positions "with much role- and setting-related anxiety,...and that their early experiences have a critical impact on their future careers" (p. 180).

One of the faculty women interviewed for this study reported that she had a "terrible first semester." She felt intimidated when she arrived at the university, and she experienced excessive pressure immediately due to something her department chair had done. The department chair had called the three new faculty members into his office together, for them to discuss their research plans and expected results. She thought he had established a competition between the new faculty members by doing that. Their being in competition made it impossible for them to cooperate or be supportive of each other, right from the start. As a result, she felt isolated and she thought her teaching had suffered because of this. She had not done as well as she otherwise could have during her first semester at the university.

This is an example of an incident (the research meeting) that a woman faculty member reported as having caused her to experience undue stress. The stress adversely affected her first semester of teaching. Even though this woman thought the department chair's establishment of the competition had been inadvertent, her reaction to the event had produced a negative consequence early in her faculty career. The woman faculty member had not realized at the time that her being in competition with the other new faculty had produced as much stress as it had, causing her first semester to not go well.

Her awareness of this had not occurred until later in her career, when she had reflected upon what had happened to her as a new faculty member.

She also recalled that after her first semester, the stress was greatly relieved when, during her performance review and in private conversations, the department chair talked to her about teaching. He made helpful suggestions and told her it was okay to "mess up," and he told her "not to over-react, but to just keep working at it in the future."

For this woman, a negative incident produced two negative career consequences. She did not do well teaching her first semester, and she was not able to cooperate with the other new faculty in the department for the support she needed early in her career. This situation was improved by the department chair's subsequent mentoring, which relieved her stress.

This incident experienced by the woman faculty member is consistent with Super's concept of "conflict," which can lead to withdrawal in career. If the stress had continued, it could have caused this woman to be unsuccessful at teaching. Without the mentoring she received, which relieved the stress she was experiencing, this woman might have begun to reconsider her participation in a faculty career in higher education. Luckily, in her case, there was mentoring to counteract the impact of the negative incident and her reaction, which could have diverted her from a faculty career. This negative incident was reported to be a powerful factor which impacted upon this woman's work role commitment, and caused her to question her non-traditional career.

Interviews were conducted with two female administrators at another university. Both women administrators reported that they had been sponsored and supported by male administrators who had sought them out and encouraged them to move into senior administrative positions at the university. The empowering male mentoring for these two women were positive career incidents, or kicks, which made it possible for them to advance successfully into non-traditional academic careers in higher education administration.

These are just three examples of the reported incidents, or "kicks," which have impacted upon the careers of the women faculty in this study. Whether the incident is positive or negative, and the woman's reaction is positive or negative, appears to influence career advancement. Although the women faculty were able to recall these incidents, it does not appear (from their reports) that they have the ability to recognize an incident as it occurs, or, that they are able to control their positive or negative response to these incidents.

CHAPTER 3
METHOD

Research Design

A survey/questionnaire, entitled "Women Faculty Career Advancement Study" (see Appendix), was used to collect academic discipline information, to measure career commitment, to identify mentors, to measure the amount of mentoring received, and to obtain additional data from women faculty. This instrument was mailed to 93 eligible women faculty at 3 public research universities, and a total of 66 completed surveys were returned by tenure track faculty respondents. These questionnaires were read, the imbedded measurement instruments for central life interests in work role and mentoring were scored for each respondent, and the data were summarized for testing. One and two-way analyses of variance (ANOVAs) (Hinkle, 1988, p. 329 & 399) were used to test the two primary hypotheses to determine the main effects for academic discipline and mentoring on career commitment, and the interaction between mentoring and academic discipline.

In auxiliary analyses, nonparametric chi-square tests of homogeneity (Hinkle, 1988, p. 562) were used to determine if science or engineering (S&E) and non-science or engineering (non-S&E) respondents differed in their opinions regarding opportunities for advancement, departmental support or competitiveness, the number of positive versus negative critical incidents they recalled, or their work related concerns. The chi-square test was also used for analyses of responses to survey items concerning whether reported critical career incidents involved more males or females.

Table 3.1 summarizes the primary hypotheses for this study and the measures and variables used in the analyses of these hypotheses:

Table 3.1. Primary Hypotheses, Measures, and Analyses Summary

Hypothesis	Measures	Analysis
1. Women faculty in science or engineering disciplines where women are a minority will score significantly higher on a measure of career commitment than women faculty in non-science or engineering disciplines which have a critical mass of women faculty.	1a. Science or engineering disciplines: Survey instrument in which each respondent lists department and college of academic employment and identifies the number of male and female faculty. 1b. Career Commitment: Score on the Central Life Interests in Work Role measurement instrument.	1. Analysis of variance: Independent variable is academic discipline; dependent variable is career commitment.
2. Women faculty who have been mentored will have more career commitment than women faculty who have not been mentored.	2a. Mentoring: Score on mentoring survey instrument. 2b. Career Commitment: Score on the Central Life Interests in Work Role measurement instrument.	2. Analysis of variance: Independent variable is mentoring; dependent variable is career commitment.

These primary hypotheses were tested:

1. Women faculty in science or engineering disciplines where women are a minority will score significantly higher on a measure of career commitment than women faculty in non-science or engineering disciplines which have a critical mass of women faculty.

Women are underrepresented on U.S. science and engineering faculties. The typical U.S. science and engineering faculty was 82.5% male in 1989 (National Research Council, 1991). Historically, there has never been a critical mass of women faculty in these disciplines. Byrne (1993) and others have identified a critical mass as important to the career advancement of women in non-traditional academic disciplines. Without this important critical mass in science and engineering, women faculty in these disciplines might be expected to have lower career commitment scores than women faculty in non-science and non-engineering academic disciplines where women represent a majority. However, to have aspired to and achieved such unusual careers in science and engineering disciplines where they are a minority, the women faculty in these non-traditional disciplines are expected to have significantly higher career commitment scores than women faculty who are in the majority in non-science and non-engineering academic disciplines.

Analysis of variance was used to study the main effect of academic discipline on career commitment. The independent variable of academic discipline was categorized as science or engineering (S&E) and non-science or engineering (non-S&E).

The dependent variable was faculty career commitment, as measured by scores on a career commitment measurement instrument.

2. Women faculty who have been mentored will score significantly higher on a measure of career commitment than women faculty who have not been mentored.

As outlined in the literature review, Super, Byrne, and others have identified mentoring or sponsorship by key figures as an important factor in the career advancement of women, especially in non-traditional academic disciplines. A belief in the need for same sex role models and mentors may have discouraged men from mentoring women in science and engineering disciplines. Without a critical mass, women faculty in the science and engineering disciplines may be at a disadvantage and have fewer opportunities for mentoring, from men or women. Women faculty who have received more mentoring are expected to have more career commitment than women faculty who have received less mentoring. However, it is suspected that women faculty in science or engineering may have even more career commitment, in spite of their having fewer opportunities for same sex mentoring.

Analysis of variance was used to determine whether women faculty in science or engineering and non-science or engineering academic disciplines differ significantly among themselves on mentoring and career commitment. The independent variable was degree of mentoring--more mentored or less mentored. The dependent variable was faculty career commitment, as measured by scores on a career commitment measurement instrument.

Table 3.2 summarizes the secondary hypotheses for this study and the measures and variables used in the analyses of these hypotheses:

Table 3.2. Secondary Hypotheses, Measures, and Analyses Summary

Hypothesis	Measures	Analysis
3. There is no difference in the career commitment of women faculty who have been mentored by men or by women.	3a. Males or females associated with mentoring: Survey instrument in which each respondent identifies mentoring received and the gender of mentors.	3. ANOVA: Independent variable is mentoring and gender of mentor; dependent variable is career commitment.
	3b. Career commitment: Score on the Central Life Interests in Work Role measurement instrument.	
4. There is no difference between women faculty in science or engineering and women in non-science or engineering concerning the competitiveness or supportiveness of their departments.	4a. Science or engineering disciplines: Survey instrument in which each respondent identifies department of academic employment.	4. Chi-square test of homogeneity: Groups are academic departments (S&E or non-S&E); nominal variable is departmental competitiveness or supportiveness.
	4b. Competitiveness or supportiveness: Responses on survey instrument.	

(table con'd.)

Hypothesis	Measures	Analysis
5. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning the opportunities for advancement in their academic departments.	5a. Science or engineering disciplines: Survey instrument in which each respondent identifies department of academic employment. 5b. Opportunities for Advancement: Response on survey instrument.	5. Chi-square test of homogeneity: Groups are academic departments (S&E or non-S&E); nominal variable is opportunity for advancement.
6. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning their reports of positive or negative critical career incidents.	6a. Science or engineering disciplines: Survey instrument in which each respondent identifies department of academic employment. 6b. Critical Career Incidents: Survey instrument in which respondents recall and describe a positive or negative career incident.	6. Chi-square test of homogeneity: Groups are academic departments (S&E or non-S&E); nominal variable is positive or negative critical career incidents reported by women faculty.

(table con'd.)

Hypothesis	Measures	Analysis
7. There is no difference in the number of positive or negative critical career incidents women faculty report they have experienced with males or with females.	7a. Critical Career Incidents: Survey instrument in which respondents recall and describe a positive or negative career incident. 7b. Males or Females associated with Critical Career Incidents: Survey instrument responses describing incidents.	7. Chi-square test of homogeneity: Groups are males or females associated with critical career incidents; nominal variable is positive or negative career incidents reported by women faculty.
8. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning what they report they would like to change about their work.	8a. Science or engineering disciplines: Survey instrument in which each respondent identifies department of academic employment. 8b. Change at work: Survey instrument in which respondents tell what they would like to change about their jobs.	8. Chi-square test of homogeneity: Groups are academic departments (S&E or non-S&E); nominal variable is what women faculty report they would like to change about their work.

The following secondary hypotheses were tested:

3. There is no difference in the career commitment of women faculty who have been mentored by men or by women.

The faculty of higher education is predominantly male. This would make males more numerically available to serve as mentors for women faculty. It might be expected that women in science or engineering would have to rely more on male faculty for their mentoring, or that women in non-science or engineering disciplines would have more opportunities for mentoring from females. However, since mentoring can come from within the department, outside the department, or even outside the university, no differences in the career commitment of women faculty by the gender of their mentors is expected.

4. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning the competitiveness or supportiveness they report within their academic departments.

It may be that academic disciplines where women are in the majority are more supportive environments for women. Arguments for the importance of a critical mass would imply this. The physical sciences and engineering are thought to be more competitive and less supportive disciplinary environments for women because they have been predominantly male. However, women who work as faculty at a university are working for the same employer whether they are in a science or engineering department or a non-science or engineering department. It could be argued that their working conditions, even in different academic departments, would be similar enough that there would be no discipline differences in the competitiveness or supportiveness they report they have experienced.

5. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning the opportunities for advancement they report within their academic departments.

Women continue to be underrepresented as faculty in the physical sciences and engineering. It may be that women have more opportunities for advancement in the academic disciplines where women represent a majority. However, women who work as faculty at a university are working for the same employer whether they are in a science or engineering department or a non-science or engineering department. It could be argued that their working conditions, even in different departments, would be similar enough that there would be no differences in their opportunities for advancement in different academic disciplines.

6. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning their reports of positive or negative critical career incidents.

Women are a minority as faculty in the physical science and engineering disciplines. As a minority, it might be expected that the incidents these women report in connection with their careers would reveal that they have experienced more difficulties than women in disciplines which already have a critical mass of women faculty. It might also be expected that critical career incidents reported by women in predominantly female academic disciplines would reflect less difficulties. However, women who work as faculty at a university are working in essentially the same higher education career, whether they are in a science or engineering department or a non-science or engineering department. It could be argued that their experiences, even in different departments, would be similar enough that there would be no differences in their critical career incidents.

7. There is no difference in the number of positive or negative critical career incidents women faculty report they have experienced with males or with females.

There are more males in the physical science and engineering disciplines. It might be expected that women faculty who report both positive and negative critical career incidents in those disciplines would associate those incidents more with the majority males. It might also be expected that women faculty who report both positive and negative critical career incidents in predominantly female academic disciplines would associate those incidents more with the majority females. Due to their shared university environment, no differences in reported positive versus negative critical career incidents, with males versus females, is expected.

8. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning what they report they would like to change about their work.

Women are underrepresented as faculty in science and engineering, so it might be argued that those disciplines are different, and perhaps more difficult, working environments for women. However, women who work as faculty at a university are working for the same employer whether they are in a science or engineering department or a non-science or engineering department. It could be argued that their working conditions, even in different academic departments, would be similar enough that there would be no discipline-related differences in what they would like to see changed about their jobs, if they could. Because of this shared working environment, no differences are expected.

Variables

The terms and constructs used as variables in this study were identified in Chapter 1, and their meanings, for testing purposes, emerged in the following ways:

Academic Discipline - Academic discipline is categorized as either science and engineering (S&E), or non-science and engineering (non-S&E), and this variable is constructed from the respondent's answer to item 4 of the survey instrument (see Appendix).

Career Commitment - Career commitment is derived from the respondent's answers to the central life interests (CLI) in work measurement instrument, items 17-23 of the survey instrument (see Appendix).

Central Life Interests - Central life interest in work role is derived from the respondent's answers to items 17-23 of the survey instrument (see Appendix).

Change - What women faculty identify as wanting to change about their work is obtained from the respondents' answers to item 16 of the survey instrument (see Appendix).

Competitiveness or Supportiveness - The competitiveness or supportiveness of the academic department is an evaluation by the respondent reported as the answers to items 24 and 25 of the survey instrument (see Appendix).

Critical Career Incidents - A critical career incident is a recalled event reported as the answer to item 35 of the survey instrument (see Appendix).

Mentoring - Mentoring received is derived from the respondent's answers to items 27-34 of the survey instrument (see Appendix).

Opportunity for Advancement - Opportunity for advancement is identified by the respondent's answer to item 26 of the survey instrument (see Appendix).

Science or Engineering and Non-science or Engineering - These categorizations were constructed from the respondent's answers to items 4 and 5 of the survey instrument (see Appendix).

The primary independent variables for this study were academic discipline (science or engineering and non-science or engineering), and mentoring. The primary dependent variable for this study was career commitment as measured by a continuously scaled central life interests (CLI) measurement instrument.

The central life interests in work role measurement instrument included in the survey for this study included the following questions:

My central life interests lie outside of my job at the university.

My main interests in life are closely related to my job in the university.

When I am worried, it is usually about things related to my job.

I believe that other things are more important than my job at the university.

Most of my energy is directed toward my job.

In talking to friends, I most like to talk about events related to my job.

My central concerns are job related.

For these CLI questions, the following response categories were used:

1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree.

Sample

A stratified sample was used for this study of tenure track women faculty from 1) traditionally male science and engineering disciplines, and 2) traditionally female non-science and engineering academic disciplines in U.S. universities. Byrne (1993) identifies physics and engineering as especially non-traditional for women, and to a somewhat lesser extent, the disciplines of chemistry, geology, math, and computing, as also being non-traditional for women. A sample of 60 women faculty was proposed. The sample of 60 would be composed of 30 in non-traditional science or engineering departments with no critical mass of women faculty, and 30 in more traditional non-science and engineering departments with a critical mass of women faculty.

Women have been identified as underrepresented as full-time and tenured faculty at public Ph.D. granting universities (Farley, 1990; Touchton, 1991). Faculty rosters and directories from three public Ph.D. granting universities were used to identify a sampling frame of tenure-track women faculty in non-traditional academic disciplines. Because there is a shortage of women faculty in non-traditional disciplines, faculty at three universities had to be surveyed in order to guarantee that a minimum sample of 30 tenure track respondents could be obtained for science and engineering.

The pool of women science and/or engineering faculty was drawn from Purdue University in Indiana (Purdue), the University of Delaware (UD), and Louisiana State University in Baton Rouge (LSU). All three institutions are public Ph.D. granting universities. At Purdue, where the 1,684 tenure track faculty is 19% female, there were just 15 women faculty in engineering in 1996. Because of the different sizes of the three universities and the different number of women faculty they employ in science or engineering, the potential pool of women science or engineering faculty varied for each university. For example, the potential pool of women science or engineering faculty at the University of Delaware was approximately 60% of Purdue's. The potential pool of women science or engineering faculty at Louisiana State University was much smaller, only about 40% of Purdue's, and only 2 women were available in the pool of tenure track engineering faculty at LSU.

Because of these differences in the number of women science or engineering faculty at each university, the sample size drawn from each school is representatively proportional. The survey form and cover letter (see Appendix) were sent to 25 women science or engineering faculty at Purdue University, 15 at the University of Delaware, and 10 at Louisiana State University. Female names were chosen at random from each university's faculty and staff roster, which identified the faculty member's academic department and faculty rank.

The rank and location of each woman faculty in this non-traditional sample was identified, and the first mailing to 50 women faculty in these non-traditional disciplines was then matched by rank with a second mailing to 50 randomly selected tenure-track women faculty in non-science and engineering academic disciplines from the same institutions, total n = 100 (Table 3.3).

Table 3.3. Summary of Surveys Mailed

Discipline	UD	LSU	Purdue
S&E	15	10	25
Non-S&E	15	10	25
Totals	30	20	50

One hundred survey forms with cover letters and return envelopes (see Appendix) were mailed to women faculty at these three universities. Of the one hundred potential respondents, four individuals with seemingly female first names in engineering departments returned their surveys and identified themselves as being males. Three women returned their surveys and reported they had left their faculty positions, which made them ineligible to participate (1 @ UD, and 2 @ LSU). There were two written declines to participate, and less response overall, from surveys mailed to faculty women at the University of Delaware. The lower response rate from the University of Delaware was attributed to concerns regarding confidentiality which were expressed verbally and in writing by the women faculty at this university.

After the initial mailing, a second reminder letter was sent. From the two mailings, a total of 67 survey forms were returned, with only one science and engineering response being too incomplete to use, for a total of n = 66 for the sample drawn from the three universities.

Of the 100 total surveys mailed, 7 turned out to be ineligible to participate (4 were males, and 3 women reported leaving their faculty positions). Of the 93 surveys mailed to women faculty who were eligible to participate in the study, 66 were returned completed, for a completion rate of approximately 71%. Borg and Gall (1989) recommend at least 20 subjects in each subgroup to be analyzed in educational survey research. This sample, which has 32 in science or engineering and 34 in non-science or engineering, exceeds that guideline. The summaries of the survey responses by institution are presented in Tables 3.4, 3.5, and 3.6.

Table 3.4. Summary of Survey Responses

Discipline	UD	LSU	Purdue	Totals
S&E	7	7	18	(32)
Non-S&E	7	9	18	(34)
Totals	14	16	36	(66)

Each respondent's survey response was reviewed to assure that she was either in a science or engineering discipline and in the minority there (below a critical mass of 30%) as a woman, or that she was in a non-science or engineering discipline and in the majority there (above a critical mass of 30%) as a woman. The fact that each reported herself to be faculty, tenured or tenure track, and full-time, was also verified (Tables 3.5 and 3.6).

Table 3.5. Survey Responses by Discipline and Tenure

Group	UD	LSU	Purdue	Totals
S&E, tenured	6	5	10	(21)
S&E, not tenured	1	2	8	(11)
Non-S&E, tenured	6	6	14	(26)
Non-S&E, not tenured	1	3	4	(8)
Totals	14	16	36	(66)

The sizes of the science and engineering departments ranged from a high of 70 total faculty to a low of 5. The science and engineering women faculty reported themselves to be in the minority within their departments (i.e. the only woman out of 55 departmental faculty, or that they were 2 of 32, 1 of 48, etc.), or that they were well below a critical mass (4 out of 70, 3 out of 44, etc.). In this sample, the largest number of women faculty in one science or engineering department was reported to be seven, in a department which had 60 total faculty. The following academic disciplines were represented in the science and engineering sample: aeronautical engineering (1), biochemistry/chemistry (8), biology/microbiology (3), botany (2), chemical engineering (1), computer science (5), ecology (1), agricultural economics (1), electrical engineering (2), food science (1), geology/geoscience (2), mathematics (3), mechanical engineering (1), physics (1).

Table 3.6. Survey Responses by Academic Rank

Rank	UD	LSU	Purdue	Totals
Full Professor	7	4	8	(19)
Associate Professor	5	7	16	(28)
Assistant Professor	2	5	12	(19)
Totals	14	16	36	(66)

The non-science and engineering departments ranged from a high of 55 total faculty to a low of 8. In each case, the women faculty reported that they were in the majority (34 out of 35, etc.) or above critical mass (9 out of 24, etc.) as women in their departments. The following academic disciplines were represented in the non-science and engineering sample: art (1), child development (4), consumer sciences (4), communication disorders (3), education studies (1), English (5), family studies (4), human ecology (4), library science (1), nursing (4), nutrition (1), sociology (1), and textiles (1).

Measures

Miskel, Glasnapp, and Hatley (1975) developed a short measurement instrument for use in assessing career commitment in educational settings. Their primary or central life interests instrument uses a simple idea. A behavior is specified and respondents are asked to indicate their agreement or disagreement.

Miskel, Glasnapp, and Hatley's (1975) shortened version of the central life interests in work instrument contains the following items:

1) My central life interests lie outside of my job at school.
2) My main interests in life are closely related to my job in the school.
3) When I am worried, it is usually about things related to my job.
4) I believe that other things are more important than my job at school.
5) Most of my energy is directed toward my job.
6) In talking to friends, I most like to talk about events related to my job.
7) My central concerns are job related. (p. 38-54)

Respondents specify whether they strongly agree; agree; disagree; or strongly disagree. The CLI in work instrument measures work role orientation with respect to each behavior (Dubin and Goldman, 1972). Individuals who are not committed to work will have lower central life interests in their jobs (Dubin and Champous, 1977).

Miskel, Glasnapp, and Hatley (1972) evaluated their central life interests research instrument for the National Center for Educational Research and Development in

Washington, D.C., using randomly selected educators in Kansas. In their final report to the Office of Education, they reported that the primary/central life interests measurement items had high face and content validity, and were evaluated as meeting both stability and reliability requirements. Their Primary Life Interests Research Instrument evaluation reported a Beta weight of .271, which differed significantly from zero @ the .05 level of significance ($F_{95} = 3.87$; df = 1,502).

The women faculty who participated in this study were asked to complete an academic career survey instrument entitled, "Women Faculty Career Advancement Study" (see Appendix). This survey had an abbreviated Miskel, Glasnapp, and Hatley (1975) central life interests in work role measurement instrument embedded within it (questions 17-23), to collect career commitment data (Table 3.7).

Table 3.7. Distribution of Commitment Scores

Score	Frequency	Score	Frequency	Score	Frequency
26	2	21	7	16	3
25	4	20	6	15	2
24	5	19	14	14	1
23	4	18	7		
22	6	17	5		

A median split of the central life interests in work role scores was used to differentiate those women faculty reporting more work role commitment and those women faculty reporting less work role commitment (Table 3.8).

Table 3.8. Median Split of Commitment Scores

More Commitment		Less Commitment	
Score	Frequency	Score	Frequency
26	2	19	14
25	4	18	7
24	5	17	5
23	4	16	3
22	6	15	2
21	7	14	1
20	6		
n = 34		n = 32	

Question 27 was included in the survey to get respondents to recall individuals and experiences which could be identified with mentoring. Questions 28-34 were also included in the survey to identify mentoring, and these questions had the same response categories as those which were used for the central life interests in work measurement instrument. The distribution of scores for questions 28-34 is reported in Table 3.9.

Table 3.9. Distribution of Mentoring Scores

Score	Frequency	Score	Frequency	Score	Frequency
28	3	23	1	18	8
27	1	22	3	17	3
26	5	21	10	15	4
25	5	20	10	13	2
24	3	19	7	12	1

A median split of the mentoring response scores was used to determine which respondents had been mentored more and which had been mentored less. In addition, a tripartite split of the mentoring scores was used in order to differentiate those women faculty reporting the most mentoring from those who reported the least mentoring (see Table 3.10).

Each respondent was asked about the competitive versus supportive working environment within her department (questions 24 and 25). And each was asked to assess whether her academic department provided opportunities for her own career advancement (question 26). Hoy and Miskel (1987) report that the opportunity for advancement is a factor important to career commitment. Each respondent was also asked to reflect on, identify, and describe a critical incident pertinent to her own career experience (question 35).

Table 3.10. Tripartite Split of Mentoring Scores

Most Mentored		Moderately Mentored		Least Mentored	
Score	Frequency	Score	Frequency	Score	Frequency
28	3			18	8
27	1	22	3	17	3
26	5	21	10	15	4
25	5	20	10	13	2
24	3	19	7	12	1
23	1				
n = 18		n = 30		n = 18	

Data Analyses

For the primary hypotheses, analyses of variance (ANOVAs) were used to determine if there were significant differences in the career commitment of women faculty in science and engineering and those in non-science and engineering academic disciplines (hypothesis 1), and between women faculty who have been mentored more and those who have been mentored less (hypothesis 2).

For the secondary hypotheses, ANOVA was used to determine if there was a significant difference in the career commitment of women faculty who had been mentored by men or women (hypothesis 3). Chi-square tests of homogeneity were used to determine if there were differences in the reports by women faculty in science or engineering and non-science or engineering disciplines regarding the competitiveness or supportiveness of their departments (hypothesis 4), their opportunities for advancement (hypothesis 5), their reports of positive or negative critical career incidents (hypothesis 6) with men or women (hypothesis 7), or what they would change about their jobs if they could (hypothesis 8).

Interviews were conducted with eight tenure track faculty women, to identify the factors and language which women faculty associate with mentoring for career advancement. These women faculty were asked to reflect on whether or not they could recall someone who had been helpful to them in their academic career. The women faculty identified those who had been helpful or supportive during their high school, undergraduate, graduate, or faculty experience. They were asked to specify what this person, or persons, said or did that was helpful to their career in academia. The results of these interviews are reported in Chapter 4.

Information and language obtained from interviews and literature review were used to develop the mentoring and mentor identification questions used in the survey instrument, items 27-34 (see Appendix).

CHAPTER 4
RESEARCH FINDINGS

Primary Analyses

The causal-comparative method was used in this study to compare samples of two groups that are categorically different on the critical variable of academic discipline, but otherwise homogeneous. Women faculty in the disciplines of science or engineering have been compared with women faculty in disciplines which are considered to be more traditional for females (i.e. nursing, home economics, etc.) drawn from the same academic population. This comparison was used to study the effects of natural variations and to identify possible contributors to the underrepresentation of women faculty in science and engineering disciplines. Complex effects such as the promotion and tenure of women faculty within higher education are surely determined by a multiplicity of factors. Therefore, secondary hypotheses were also tested to identify additional variables with which to compare and contrast the study groups.

The primary hypotheses for this study attempt to identify the influence of the independent variables of academic discipline and mentoring on the dependent variable, the career commitment of women faculty. Two-way Analysis of Variance (ANOVA) was used to determine if there is any interaction between discipline and mentoring which may affect career commitment. As noted in the following summary table, this analysis of faculty career commitment found only academic discipline to be a significant variable. Mentoring was not found to be significant in this analysis, and no interaction was found between academic discipline and mentoring.

Table 4.1. Summary ANOVA, Central Life Interests in Work Role Scores of Women Faculty by Academic Discipline and Mentoring

Source	SS	df	MS	F	Significance
Discipline	38.5	1	38.5	4.8	.03
Mentoring	4.9	1	4.9	0.6	.45
Interaction	0.8	1	0.8	0.1	.75
Within	493.6	62	8.0		
Total	537.8	65			

Results for hypothesis:

1. Women faculty in science or engineering disciplines where women are a minority will score significantly higher on a measure of career commitment than women faculty in non-science or engineering disciplines which have a critical mass of women faculty.

Each respondent was asked to identify her department of employment (question 4) and to report the number of male and female faculty employed within the department (question 5). Responses on the survey instrument were used to determine whether or not that woman could be categorized as employed within a science or engineering discipline where women faculty are a minority. The Central Life Interests in Work Role scores (questions 17-23) of the women in science or engineering were then compared to the Central Life Interests in Work Role scores of women in non-science or engineering departments with a critical mass of women faculty.

Women respondents working in science or engineering departments, without a critical mass of women faculty, scored higher on this measure of career commitment than women faculty working in the non-science or engineering departments which had a critical mass of women faculty (Table 4.2).

Table 4.2. Central Life Interests in Work Role Scores of Women Faculty by Academic Discipline

Academic Discipline	N	Mean Score	SD
Science or Engineering (w/o critical mass of women)	32	21.0	3.2
Non-science or Engineering (w/ critical mass of women)	34	19.4	2.4

These results indicate there is empirical support for hypothesis 1. The null hypothesis of no difference in the career commitment of women faculty in science or engineering and women faculty in non-science or engineering is rejected at the probability < .05 level of significance. Table 4.3 shows that women faculty in science or engineering had significantly higher career commitment (central life interests in work role) scores.

Table 4.3. Summary ANOVA, Central Life Interests in Work Role Scores of Women Faculty by Academic Discipline

Source	SS	df	MS	F	Significance
Between	38.5	1	38.5	4.9	.03
Within	499.3	64	7.8		
Total	537.8	65			

Results for hypothesis:

2. Women faculty who have been mentored will have more career commitment than women faculty who have not been mentored.

In the survey, each respondent was asked to identify a mentor (question 27) and to identify other people who had been helpful to her career (questions 28-34). The information given by the respondents was scored, and the respondents' scores were median split to identify the respondents as reporting more mentoring or less mentoring. The career commitment scores of women who reported they were mentored more was then compared to the career commitment scores of women who reported they were mentored less.

Women respondents who reported that they had been more mentored scored only slightly higher on this measure of career commitment than women respondents who reported they had been less mentored (Table 4.4).

Table 4.4. Central Life Interests in Work Scores of Women Faculty by Mentoring, Using a Median Split

Mentored	N	Mean Score	SD
More	33	20.5	2.5
Less	33	19.9	3.2

The following ANOVA shows this difference was not statistically significant.

Table 4.5. Summary ANOVA, Central Life Interests in Work Role Scores of Women Faculty by Mentoring, Using Median Split

Source	SS	df	MS	F	Significance
Between	4.9	1	4.9	.6	0.45
Within	532.9	64	8.3		
Total	537.8	65			

In an additional exploratory attempt to find some difference in career commitment which could be attributed to mentoring, the respondents' scores were also tripartite split (see Table 3.10) to identify respondents reporting the most mentoring, or the least mentoring. The career commitment of women who reported they were mentored the most was then compared to the career commitment of women who reported they were mentored the least (Table 4.6).

Table 4.6. Central Life Interests in Work Scores of Women Faculty by Mentoring, Using the Upper and Lower Portions of a Tripartite Split

Mentored	N	Mean Score	SD
Most	18	20.3	2.1
Least	18	19.8	3.3

Analysis of commitment scores using the tripartite split is shown in Table 4.7.

Table 4.7. Summary ANOVA, Central Life Interests in Work Role Scores of Women Faculty by Mentoring, Using Tripartite Split

Source	SS	df	MS	F	Significance
Between	1.8	1	1.8	0.2	0.63
Within	260.1	34	7.7		
Total	261.9	35			

Women respondents who reported that they had been mentored the most did not score significantly higher on this measure of career commitment than women respondents who reported they had been mentored the least.

The hypothesis that women who have been mentored will have more career commitment was still rejected.

In survey questions 28-32, respondents were asked to evaluate how helpful different categories of people had been to their careers. The average scores for each category were calculated to identify sources of support and any differences between women in science or engineering and women faculty in non-science or engineering departments (Table 4.8).

Table 4.8. Ranking of Helpful People by Category and Academic Discipline

Helpful People	Mean Score: S&E	non-S&E
Family, Friends or Peers	3.4	3.4
Teachers or Supervisors	3.1	3.2
Academics Outside This University	3.0	3.0
Within My Department	2.8	2.7
In University, Outside My Department	2.5	2.5

There were no significant differences between women in science or engineering and women in non-science or engineering departments in the ranking of these categories of people who had been helpful to their careers. Both the science or engineering and non-science or engineering faculty women responded with the highest scores for family, friends or peers as being the most supportive of their careers, and with the lowest scores for people within their university but outside their department as being the least helpful.

In survey questions 33 and 34, respondents were asked about how women and men had advised or encouraged, and been supportive of their careers. The average scores for each were calculated to identify any differences between women in science or engineering and women faculty in non-science or engineering departments (Table 4.9).

Table 4.9. Ranking of Supportive People by Gender and Academic Discipline

Supportive People	Mean Score:	S&E	non-S&E
Males		3.1	3.0
Females		2.6	3.0

Women in science or engineering had higher scores for support received from men. Women faculty in non-science or engineering scored men and women as equally supportive.

On the survey instrument, there were seven questions (28-34) dealing with the identification of categories of people who had been helpful or supportive of the careers of the women faculty respondents. As noted previously, there was no difference in the ranking of mean scores for these seven categories of helpful or supportive people between the science or engineering faculty women and the non-science or engineering faculty women.

Analyses of variance were used to see if there were any significant differences in the scores by category between academic disciplines. Only question 33, regarding the career support of women by other women, was statistically significant. The women faculty were compared using academic discipline as the independent variable and their scores for question 33, regarding career support from other women, as the dependent variable (Table 4.10).

Table 4.10. Summary ANOVA, Career Support from Women by Academic Discipline

Source	SS	df	MS	F	Significance
Between	2.5	1	2.5	3.3	0.08
Within	49.2	64	.8		
Total	51.7	65			

These results indicate there is some empirical support for rejecting a null hypothesis of no difference between the career support of women faculty by other women, in science or engineering and non-science or engineering academic disciplines. However, the rejection of the no difference hypothesis is only marginally supported at the probability < .10 level of significance.

Secondary Analyses

Results for Hypothesis:

3. There is no difference in the career commitment of women faculty who have been mentored by men or by women.

The respondents who identified people who had been helpful to their career in question 27 were also asked to identify the helpful person's gender. Men were identified as helpful by 34 respondents, and women were identified as helpful by 22 respondents. Fifteen of the respondents did not identify anyone who had been helpful to their career.

As previously noted, the responses to questions 28-34 were scored and median split to identify respondents as mentored more or less. The career commitment scores of women who reported they were mentored more, by men or women, was then compared to the career commitment of women who reported they were mentored less, by men or women (Table 4.11). Five respondents, who were all reporting that they had been more mentored, identified both a male and a female mentor. For these five cases, their individual scores were included in both the male and the female cells of the more mentored category.

Table 4.11. Central Life Interests in Work Role Scores of Women Faculty by Mentoring and the Gender of the Mentor Identified

Mentored	N	Mean Score	SD
More, by male	19	20.2	2.3
More, by female	14	20.4	0.5
Less, by male	15	20.9	3.4
Less, by female	8	18.4	2.3

Women respondents who reported that they had been mentored more, and identified a female mentor, did not score significantly higher on this measure of career commitment than women respondents who reported they had been mentored more and identified a male mentor. However, women respondents (n = 23) who reported they had been mentored less, and identified a male mentor, had higher career commitment scores than women respondents who reported they had been mentored less, and identified a female mentor.

The women who reported they had been mentored less were then compared using the gender of the mentors they identified as the independent variable and career commitment (central life interests in work role) scores as the dependent variable (Table 4.12).

Table 4.12. **Summary ANOVA, Central Life Interests in Work Role Scores of Less Mentored Women Faculty by Gender of Mentor**

Source	SS	df	MS	F	Significance
Between	34.2	1	34.2	3.6	.07
Within	196.8	21	9.4		
Total	231.0	22			

For hypothesis 3, the null hypothesis of no difference in the career commitment of women faculty who are mentored by men or by women, these results indicate there is some empirical support for rejecting the null. However, the rejection of the no difference hypothesis is only marginally supported at the probability < .10 level of significance.

4. There is no difference between women faculty in science or engineering and women in non-science or engineering disciplines concerning the competitiveness of supportiveness of their departments.

The respondents were asked to evaluate the work environment within their departments as being either competitive (question 24) or cooperative and supportive (question 25). The reports of competitive or supportive work environments were then grouped by academic discipline, to determine if there was any difference in the opinions of women faculty regarding the competitiveness or supportiveness of their departments (Table 4.13).

Table 4.13. Chi-square Test of Homogeneity by Academic Discipline and Departmental Environment

Group	Observed	Expected
S&E, Competitive	13	11.7
S&E, Supportive	16	17.3
Non-S&E, Competitive	10	11.3
Non-S&E, Supportive	18	16.7

The chi-square computed value (0.5) does not exceed the critical value (3.8). No difference was found in the departmental competitiveness or supportiveness reported by women faculty in science or engineering and women faculty in non-science or engineering academic disciplines.

5. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning the opportunities for advancement in their academic departments.

The respondents were asked if their department offered opportunities for them to advance and be rewarded for their work (question 26). Their assessment of advancement opportunities as positive or negative was then grouped by academic discipline, to determine if there was any difference in the opinions of women faculty regarding advancement opportunities in their departments (Table 4.14).

Table 4.14. Chi-square Test of Homogeneity by Academic Discipline and Advancement Opportunity

Group	Observed	Expected
S&E, positive	19	19.6
S&E, negative	12	11.4
Non-S&E, positive	22	21.4
Non-S&E, negative	12	12.6

The chi-square computed value (0.1) does not exceed the critical value (3.8). No difference was found in the advancement opportunity reported by women faculty in science or engineering and women faculty in non-science or engineering academic disciplines.

6. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning their reports of positive or negative critical career incidents.

When the women faculty were asked to recall significant experiences from their past which had an impact (positive or negative) on their career (question 35), there were

37 work related critical incidents reported by 36 of the respondents. The positive and negative incidents reported were compared by academic discipline (Table 4.15).

Table 4.15. Critical Career Incidents by Academic Discipline

Academic Discipline	Positive Incidents	Negative Incidents
Science or Engineering	7	8
Non-science or Engineering	8	14

More negative incidents were reported by women faculty in the non-science or engineering disciplines. This difference was tested for significance (Table 4.16).

Table 4.16. Chi-square Test of Homogeneity by Discipline and Incident

Group	Observed	Expected
S&E, positive	7	6.1
S&E, negative	8	8.9
Non-S&E, positive	8	8.9
Non-S&E, negative	14	13.1

The computed chi-square value for critical incidents by academic discipline (0.4) does not exceed the chi-square critical value (3.8). Therefore, hypothesis 6, the null hypothesis of no difference was not rejected. The opinions of the science or engineering and non-science or engineering women faculty are similar regarding positive and negative critical career incidents.

7. There is no difference in the number of positive or negative critical incidents women faculty report experiencing with males or with females.

Some critical incident stories identified the gender of the other individual(s) involved in the experience. Since these critical incident stories often identified more than one person, the number reported in Table 4.17 is larger than that of Tables 4.15 and 4.16. Respondents also referred to their experiences with students, the department, the university, or some other non-gendered group.

Table 4.17. Critical Career Incident References by Gender

Group	Positive	Negative
Males	8	19
Females	5	2
Non-gendered	7	9

Males were more often referred to as not being helpful, and associated with negative career experiences. Females were more often referred to as being helpful, and associated with positive career experiences. Non-gendered references were about equally split between positive and negative career experiences.

Table 4.18. Chi-square Test of Homogeneity by Gender and Critical Incidents

Group	Observed	Expected
Males, positive	8	10.3
Males, negative	19	16.7
Females, positive	5	2.7
Females, negative	2	4.3

The computed chi-square value (4.1) exceeds the chi-square critical value (3.8). Therefore, hypothesis 7, the null hypothesis of no difference was rejected. The critical career incidents experienced by women faculty with males and females are not the same. Significantly more of the experiences they reported as being negative and not helpful to their careers were identified with males.

8. There is no difference between women faculty in science or engineering and women faculty in non-science or engineering disciplines concerning what they report they would like to change about their work.

To identify work related concerns, respondents were asked question 16, "If you could change only one thing about your job, to make it better for you as a woman, what would it be?" There were 27 S&E responses and 31 non-S&E responses, as shown in Table 4.19.

Table 4.19. Summary of Work Related Concerns by Academic Discipline

Response	Number reported in S&E	Non-S&E
1. More acceptance or respect	9	2
2. More women (or men) faculty	7	1
3. Fair or more compensation	0	7
4. More travel/research support	1	5
5. Administrator/colleague problem	0	5
6. Reduced teaching or work load	2	3
7. Flex appointment or summer off	2	1
8. Replace tenure w/ contracts	2	0
9. Childcare on-campus	2	0
10. Jobs for career spouses	1	1
11. Publishing assistance	0	2
12. Other	1	4

For women faculty in science or engineering, the most frequent responses to this open-ended question were the need for more acceptance or respect, and more women faculty. For the non-science or engineering women faculty, the most frequently given responses were regarding the need for more compensation, the need for funding for travel or research, and comments about problems with administrators and/or colleagues.

To identify any significant response differences by academic discipline, the concerns of these women faculty were grouped. Responses 1 and 2 were combined as category 1, relating to acceptance and respect. Responses 3, 4 and 5 were combined as category 2, relating to economic issues and problems with people. The remaining responses were combined as category 3, for other concerns (Table 4.20).

Table 4.20. Chi-square Test of Homogeneity for Concerns by Academic Discipline

Group	Observed	Expected
S&E, category 1	16	8.7
S&E, category 2	1	8.3
S&E, category 3	10	9.8
Non-S&E, category 1	3	10.3
Non-S&E, category 2	17	9.7
Non-S&E, category 3	11	11.2

The computed chi-square value (23.0) exceeds the chi-square critical value (6.0). Significantly more of the women faculty in science or engineering have concerns in category 1 regarding their acceptance or respect, and significantly more of the non-science or engineering faculty women have concerns in category 2 regarding economic issues and their problems with other people. These results suggest that the academic disciplines are not the same, and the women working in science or engineering departments have different concerns than the women faculty who work in non-science or engineering departments.

Hypothesis 8, the null hypothesis of no difference was rejected. The work related concerns of women faculty in science or engineering and the work related concerns of women faculty in the non-science or engineering academic disciplines are not the same.

Interviews

Eight tenure-track women faculty from the three universities were interviewed. Four of the women were in departments where women had achieved a critical mass (more traditional disciplines for women), and four were in departments where women had not yet achieved a critical mass (non-traditional disciplines for women).

The women were asked to identify people who had been helpful to their careers when they were an undergraduate, in graduate school, or as a faculty member. The descriptive words the women used for these people were noted, as well as what the women said these people had done which was helpful to their careers. Although all of the women identified people who had been helpful to their careers, only three of the eight women thought that they had actually been mentored. Five of the women thought there had been no one individual who had been helpful enough, or had functioned in a comprehensive capacity which they associated with the role of a mentor. These five women said they did not think they had been mentored.

Table 4.21. Summary of Women Faculty Interviewed

ID#	Discipline	Helped by	Interview Status	Current Status
1	Education	M & F	Assoc. Prof., tenured	(same)
2	Education	M & F	Asst. Prof., untenured	Assoc., tenured
3	Home Economics	M & F	Assoc. Prof., tenured	(same)
4	Agriculture	M & F	Assoc. Prof., tenured	Dept. Chair
5	Chemistry	M & F	Asst. Prof., untenured	Assoc., tenured
6	Criminal Justice	M & F	Assoc. Prof., tenured	Full Prof.
7	Communication	M	Assoc. Provost, tenured	(same)
8	Business	M	Full Prof., tenured	Provost

All of the interviewed women identified males who had been helpful to their careers, and all of these women expressed a commitment to continuing in their academic careers. The women interviewed for this study have maintained (3) or have already advanced (5) in their academic careers. The three women who have stayed at the same level had already achieved tenure, so the ability of these eight women to maintain their academic careers is assured.

In the interviews, the women identified what people who had been helpful to their careers had done that was helpful. Although each woman interviewed could identify someone who had done one or more of these helpful things for her since she had become a faculty member, a majority (five of the eight) did not think they had been mentored. To them, mentoring meant much more than one helpful act, or even a few helpful acts. They saw mentors as people who would come to them, offer to take them under their wing, and then do the helpful things they identified. Most of the women said they knew what mentoring was because they had observed the junior faculty men in their departments being mentored by senior faculty men or administrators. They reported that nothing comparable was being done for them.

The constant comparative technique advanced by Lincoln and Guba (1985) was used to process the data obtained in the interviews. The constant comparative technique is a way to identify and categorize units of data.

In this study, units of information were extracted from the notes taken during interviews with women faculty. Each helpful or supportive behavior they had identified became a unit. The individual units were compared to see if they were similar or different, and categories emerged from these comparisons. When all the units of behaviors had been assigned to categories, each category was reviewed until a theme or rule emerged, and then it was named. The resulting category sets from this process were reviewed again, to be sure the units within each category were homogeneous and that the categories themselves were heterogeneous.

This analysis revealed that helpful behaviors or actions identified by the women faculty could be grouped into four areas which the women assessed as beneficial to their career advancement. The four areas of helpful actions or behaviors which emerged were identified as 'supportive,' 'skill development,' 'promotion' and 'guidance.'

Supportive: Gave them emotional support, accepted them, were thoughtful and caring, encouraged, believed in them, built their confidence, made it okay to make mistakes or even to fail and learn from it, helped them to grow, parented, were friends, offered to help, complimented them on their work, got them involved in support groups, welcomed them when they first arrived, often came to their office, invited them to lunch or dinner, helped them to work through personal decisions, checked to see how they were doing, were willing to listen, the door was always open, met and talked with them, respected them.

Skill Development: Helped develop their skills and taught them new skills, instructed, set examples, set standards, modeled successful professional behavior, presented projects in manageable pieces instead of as big overwhelming jobs, allowed them to work independently, were good editors, taught them research and professional skills, gave honest and friendly feedback on their work, brain-stormed with them, encouraged them to develop their interests and try new things, suggested new things to try, gave them release time to write, monitored their progress, pushed their thinking, shared work in progress with them, involved them in proposals, grants, papers and publication.

Promotion: Nominated and promoted them, helped to get them promoted, were an advocate for them, wrote glowing letters of recommendation, created opportunities for them and pointed out where to go next, explained the tenure process in detail, actively intervened on their behalf to head off potential problems.

Guidance: Advised, counseled, helped them to work through professional decisions, told them what did and did not work, discussed issues with them, helped them to negotiate the political waters, showed them how to relate effectively with colleagues, made sure they were involved in meetings and met people important to their work, helped them to make contacts, told them who to avoid.

These women faculty were able to identify more actions in the supportive and skill development categories which had been helpful to them, but they saw the actions in the promotion and guidance categories as being especially important to their career advancement.

The categories of people who had mentored or been helpful to these women or supportive of their careers was also noted. The categories were:

People within the same academic department.

Others in the same university, but outside this academic department.

Others in academia, outside this university.

Family, friends, or peers.

Teachers or supervisors.

Women and men.

These categories were used to develop survey questions 28-34, for the identification of career support received from others.

In addition, because critical incident stories were recalled by the eight interviewed women faculty, question 35 was included in the survey instrument, to get respondents to recall and identify critical incident stories pertaining to their careers.

CHAPTER 5
SUMMARY AND DISCUSSION

Summary of Problem and Method

Although women are well represented and have achieved a critical mass as faculty in the traditionally female disciplines of higher education, like nursing and home economics, women continue to be underrepresented and have not yet achieved critical mass as tenure track and tenured faculty in the physical sciences and engineering. Why are women underrepresented as university faculty in the physical sciences and engineering? Is there a difference in the career commitment of women faculty in different academic disciplines that explains this? Perhaps women in academic disciplines which already have a critical mass of women faculty receive more mentoring from the other women in their department. Does mentoring influence the career commitment of women faculty?

Two primary hypotheses were proposed for study:

1. Women faculty in science or engineering disciplines where women are a minority will score significantly higher on a measure of career commitment than women faculty in non-science or engineering disciplines which have a critical mass of women faculty.
2. Women faculty who have been mentored will score significantly higher on a measure of career commitment than women faculty who have not been mentored.

A survey was mailed to 100 women faculty at three public Ph.D. granting universities to collect data on their academic disciplines, career advancement status, career commitment, and the mentoring they had received. In addition, eight women faculty were each interviewed once in-depth to collect data on the mentoring experiences of women in higher education.

A career commitment measurement instrument was embedded in the survey instrument and a career commitment score was obtained for 66 women faculty. To test hypothesis one, analysis of variance (ANOVA) was used to compare the career commitment scores of women faculty in science or engineering disciplines with the scores of women faculty in non-science or engineering disciplines.

A mentoring measurement instrument was included in the survey instrument and a mentoring score was obtained for 66 women faculty. A bi-polar split was used to identify the women faculty as being either more mentored, or less mentored. In addition, a tripartite split was used to identify the women faculty who had been mentored the most, and those who had been mentored the least. To test hypothesis two, ANOVA was used to compare the career commitment scores of women faculty who reported more mentoring with the scores of women faculty who reported less mentoring.

Additional survey instrument data analyses included comparison of the career commitment of women faculty by level of mentoring and gender of the mentor, comparison of competitiveness or supportiveness of the work environments, comparison of the opportunity for advancement within the work environments, an analysis of critical incidents, and the identification of factors respondents said they would change to make their jobs better.

Interview data were analyzed and summarized in order to identify and categorize behaviors and actions which women respondents said were helpful to their career advancement in higher education.

Interpretation of Results

Hypothesis 1: Women faculty in science or engineering disciplines where women are a minority will score significantly higher on a measure of career commitment than women faculty in non-science or engineering disciplines which have a critical mass of women faculty.

This hypothesis was not rejected. In the study, women respondents in science and engineering departments, where women faculty are a minority, scored significantly higher on the Central Life Interests in Work Role measurement instrument than women employed in the academic disciplines where women already represent a majority of the faculty. For the non-science or engineering women faculty, a critical mass did not result in their having higher work role commitment scores. Conversely, the lack of a critical mass in science and engineering did not result in lower career commitment.

Since the literature associates career commitment with perceptions of opportunity for rewards, these findings suggest that it is the women faculty in the physical sciences and engineering who perceive their careers as being able to yield greater opportunities for economic rewards. Though the women in the sciences or engineering most often reported a need for more women faculty colleagues, and more acceptance or respect within their departments, none of the science or engineering women reported the need for more compensation or funding to be an issue. In contrast, the need for fair or more compensation, or more travel or research funding, were the most often mentioned concerns of the non-science or engineering women faculty, who had lower career commitment scores.

For the women in this study, higher work role commitment scores were associated with the science and engineering disciplines, where there are greater financial rewards. Women faculty in the non-science or engineering disciplines, who were more concerned about inadequate compensation, or inadequate financing for travel and research, did not score as high. This would suggest that economics does play an important role in female career commitment. The opportunity for compensation, and travel and research funding rewards, can be associated with higher levels of work role commitment for women faculty.

Hypotheses 2 & 3: Women faculty who have been mentored will score significantly higher on a measure of career commitment than women faculty who have not been mentored, and, there is no difference in the career commitment of women faculty who have been mentored by men or by women.

Hypothesis 2 was rejected. Women faculty who reported that they were more mentored did, indeed, have higher career commitment scores, but their scores were not significantly higher than the career commitment scores of the women faculty who reported that they had been less mentored. Additionally, no interaction was found between the variables of academic discipline and mentoring.

When the genders of the reported mentors were identified and career commitment scores were compared by academic discipline and the gender of the mentor, a difference in scores was observed, but the statistical difference was only marginally significant.

There was some empirical support for rejecting Hypothesis 3. The women who considered themselves to be less mentored, and who identified a woman as having been their mentor, had lower work role commitment scores. However, the statistical difference in scores was only marginally significant.

Senior women faculty and administrators in higher education, who have achieved career advancement, are often called upon to mentor junior women faculty. In departments where there are many junior women and few or only one senior woman faculty, the few senior women mentors available in a department or college may not be able to keep up with all the mentoring needs of incoming women faculty.

One respondent in this study reported, "I have always been 'alone' -always the only woman in my classes, in my graduate program, in my faculty department. I am tired and worn out from being everyone's role model." Another respondent commented, "Because [there are] so few women faculty, I am 'on call' for everything. Then I am criticized for not spending enough time on research and proposals."

The underrepresentation and overutilization of women in higher education may frustrate new women faculty members, who may not get the mentoring which they had expected--not just from women in senior level positions, but from anyone. One woman wrote, "We have no formal system of mentoring in this department, and certainly no one took me on informally. I understand that some of the male Full Professors do this for the male Assistant Professors. What a surprise..."

Women who are in the minority in an academic discipline and paired with other women faculty for mentoring, may get the message that they are seen first as women, then as colleagues. This may lead the less mentored new faculty member to feel that she does not belong, and this might diminish her confidence and career commitment.

Although women have achieved career advancement in higher education, they are still below a critical mass as tenured faculty and administrators. It is still men who are in the majority as tenured faculty in most academic departments. Since there are more senior men than senior women in most academic departments, the men have a numerical advantage which makes them more available for the mentoring of junior faculty. A junior woman faculty, who may not have expected to be mentored by a male, might see the association as a special recognition.

Several of the respondents in this study reported their male advisors' encouragement and belief in their abilities made them feel "respected" and "valued." They said their male mentors had been "instrumental" in their decisions to pursue academic careers. These women could be identifying this male/female mentoring as an acknowledgement of their potential by a senior colleague, someone who has achieved professional success and has credibility. When the junior woman faculty considers this mentoring to be a "reward" for her potential, then she would see herself as belonging, and this could enhance her confidence and career commitment.

The women faculty in this study who received more or less mentoring by men, or more mentoring by women, were identified as having higher work role commitment scores than women faculty who were less mentored by women. The results obtained from these respondents suggest that the work role commitment of women faculty may be affected by the inadequate mentoring of women, by women. This finding would be of interest to senior women faculty and to the departments, colleges, and universities which may expect their few senior level women faculty to mentor incoming junior women. Having male senior faculty mentor female junior faculty would be easier to orchestrate in departments where men are in the majority, and it may produce more desirable results, especially where women are underrepresented and the intent is to enhance the career commitment of incoming women faculty.

Another interesting finding was that there was no difference between the disciplines in the ranking of helpful or supportive groups of people (Tables 4.8 and 4.9). Family, friends or peers were considered to be the most helpful, and people at the university but outside the department were considered to be the least helpful.

The women faculty in science or engineering gave significantly lower scores to the support they had received from other women. This is certainly no surprise, as most of the science or engineering women in this study represented the only woman in their department. They reported that most of the support for their careers, other than from family, friends or peers, had come from teachers, supervisors, other academics, and colleagues in their departments, who would be almost entirely male. Due to the male composition of the science and engineering disciplines, the possibility of career support from other women would be significantly less.

Hypotheses 4 & 5: There is no difference between women faculty in science or engineering and women in non-science or engineering concerning the competitiveness or supportiveness of, or opportunity for advancement within, their departments.

Hypotheses 4 and 5 were not rejected. Respondents in this study were asked to evaluate their departmental work environments as competitive or supportive, and to assess their own advancement opportunity. There was no significant difference between the responses of the women in science or engineering and the women in other disciplines regarding their work environments or opportunities for advancement.

Although there was no difference in response by academic discipline, there were more women who thought their departments were supportive [n= 34 (16 S&E, 18 non-S&E)], than there were women who thought their departments were competitive [n = 23 (13 S&E, 10 non-S&E)]. In university work environments, where faculty may have to compete at the college level for a limited number of tenure approvals, it was somewhat unexpected that a majority of the respondents would assess their departmental work environment as being supportive. As previously noted, Sonnert and Holton (1995) studied a large sample of women research faculty who reported they had experienced less collaboration with their colleagues than had their male peers.

It was also noted that more women thought their departments offered them opportunities to advance and be rewarded for their work [n = 41 (19 S&E, 22 non-S&E)], than there were women who had not assessed their opportunities as positively [n = 24 (12 S&E, 12 non-S&E)].

The possibility was examined that tenure status might influence whether or not women faculty considered their departments to be supportive, or their belief in whether or not they had opportunities to advance. In this study, the tenured women did not evaluate their environment as more supportive nor their opportunities as any better than those of untenured women. Tenure, or lack of tenure, did not appear to influence the responses to these questions.

Women at all three universities, in science or engineering and also in non-science or engineering disciplines, reported that their careers in higher education had been jeopardized because they had children. One woman engineer said of higher education, "This place is not human, not for women. Although I out performed all the male faculty in my department, in grants, funding, publications, and in teaching, they claim that I taught less than they required for tenure because I had a baby during one semester, with no teaching assignment given by the chair." Another woman said, "My commitment to the discipline was questioned because I had a child in [year] and thus had a gap in publications." A woman reported, "I had a baby my first year at [university] and survived the university's wrath. I was pressed to resign, but I did not. I am still somewhat a legend for having a family and a real career."

There was a related report of how faculty women in one department had 'networked' to support each other in their careers. "The senior colleague (male) in my program covertly warned me not to get pregnant... He did it in my second year, in a context where it was very clearly a threat about tenure. It was horrible, but at the same time somewhat empowering, because that was the point at which I put my foot down and reported him to my department head. Now he just does it to other young female faculty, but I warn them about him, and they're prepared. We've sort of formed a protective network through which we warn each other about what to expect. But it certainly would be nice to be able to not need such a thing."

In this study, there were no significant differences in the career commitment scores of women who had children and women who did not have children. There was also no relationship between the number of children and career commitment scores.

Although negative critical incidents and set-backs were experienced, most of these women also reported that they persevered, or intend to persevere, and they enjoy their careers in higher education. For example, a woman in mathematics wrote, "I've got my self respect, and work that I passionately love that requires everything I've got intellectually and creatively. I make a good living for myself, have a home here in [state], and have friends that I love dearly all over the world. I even managed to buy myself a nice house. All in all, I'm happy."

It is this reported experience of enjoyment and satisfaction with a career in higher education which is the most obvious explanation for the majority of these women having positive opinions about their departments and their future opportunities.

Hypothesis 6: There is no difference between women faculty in science or engineering and women faculty in non-science or engineering concerning their reports of positive or negative critical career incidents.

Hypothesis 6 was not rejected. Critical incident stories were both positive and negative, with the non-science & engineering women faculty reporting the most negative incidents (though not statistically significant). Interestingly, it was also the non-science and engineering women faculty who reported having problems with colleagues or administrators.

In two of the universities from which respondents were drawn, the administration of the traditionally female home economics colleges had been changed from female to male leadership, at the dean and several of the department chair levels. Even the names of the colleges and departments had been changed. Several women faculty reported that the replacement of their female leaders with males, and the name changes, were their university's attempt to enhance the professional credibility of the college. These gendered administrative changes may explain, in part, some of the reports by the non-science and engineering women faculty that they have experienced more negative critical incidents, and more administrator or colleague problems.

Hypothesis 7: There is no difference in the number of positive or negative critical career incidents women faculty report they have experienced with males or with females.

Hypothesis 7 was rejected. Most of the critical incident stories involved a male, and most of the negative critical incident stories reported involved an interaction with a male. This finding was statistically significant. One possible explanation for this is that women continue to be a minority of all the full-time post-secondary faculty in the U.S. (Farley, 1990). Women faculty would, therefore, have more interactions (both positive and negative) with the male majority. However, as noted in Table 4.17, the negative career incidents women had experienced with men occurred more than twice as often as their positive career experiences with men. And the women in this study reported almost ten times more negative career experience with males than with females. These findings point to a very significant male role in the negative career incidents experienced by females in higher education.

Hypothesis 8: There is no difference between women faculty in science or engineering and women faculty in non-science or engineering concerning what they report they would change about their work.

Hypothesis 8 was rejected. There was a very significant difference between the concerns of women faculty in science or engineering and non-science or engineering departments.

When asked what one thing they would change, to make their jobs better for them as women, most of the science and engineering faculty responded that they would like more acceptance or respect, and more women faculty colleagues added to their department. It is possible that a lack of acknowledgement by their male colleagues, or even a lack of helpful interaction with their male colleagues, has led them to believe that they were not yet accepted or respected. It is also possible that their being in the minority in an academic discipline which is non-traditional for women is a lonely and heavy responsibility that is still not adequately recognized by male colleagues, and that this environment would be less difficult for these women if there were other women faculty colleagues.

For the non-science and engineering women faculty, the changes they would prefer related to improving their compensation or their support for travel and research, and dealing with problems related to colleagues or administrators. As reported in The Chronicle of Higher Education and many other publications, science and engineering faculty usually receive higher salaries than home economics or nursing faculty, and historically, male faculty have received higher salaries than female faculty at all academic ranks (Touchton and Davis, 1991). These discipline and historical gender compensation differentials could explain the concern regarding the need for fair or more compensation or support expressed by these non-science and engineering women faculty.

Interviews: The interviews for this study revealed that the concept of "a mentor" is problematic for some women faculty, just as it is for men. Even though each of the eight women faculty interviewed for this study could identify one or more men or women who had been helpful to her career, only three of the eight thought that they had actually been mentored according to their definition of the term. The other five women had defined what a mentor does as being so comprehensive that it did not seem possible for any one individual to have functioned in that capacity and have accomplished anything else.

The interviewed women reported that their expectations regarding what mentoring should be came from having observed senior male faculty provide mentoring for junior male faculty within their departments. They reported that they were not being provided with as much mentoring as their male colleagues.

When asked if they had ever gone to senior male faculty and requested mentoring, one woman said that was expecting too much. She said the power differential for women to overcome was too great for women to ever be able to ask senior male colleagues to go out to lunch, let alone to ask for mentoring. The idea of asking for mentoring did not seem to be a consideration. One woman said, "Why should I have to ask for mentoring? The men do not have to ask for it."

Limitations

The sample of women for this study, all of whom have doctoral degrees and are tenure-track faculty at Ph.D. granting research universities, is certainly not typical of the population of all women in the work force. These women may very well have higher than average levels of career commitment to begin with. They have stayed in college beyond their bachelor's degree work for the additional three or four or more years required to complete a doctoral degree. They have gone on to compete successfully for positions at research institutions.

Since the women in this study are unique in the work force, the results reported here are relevant only to women faculty in public research institutions of higher education, a group which may have little or no relationship to any other group of women workers in the population.

This study provides no information on the career commitment and mentoring of men and minorities working in the academic disciplines in higher education where they are underrepresented. Therefore, no comparisons or inferences can be made regarding the career commitment and mentoring of faculty women, and that of men or minorities.

Implications

Theory: The career development and higher education literature identify work role commitment as being essential for advancement. Numerically, more women have advanced in their careers in the non-science and engineering disciplines of higher education, and women are still underrepresented as faculty in science and engineering. This would suggest that where women are less successful in advancing, they have less career commitment. However, in this study, the career commitment scores of women faculty in science and engineering, where women are underrepresented, were higher than those of women faculty in the non-science and engineering disciplines, where women have been more successful in achieving a critical mass. How can this be explained? Perhaps there is a "threshold" of commitment necessary for women to qualify for a faculty career. If women have already passed this threshold of commitment in obtaining their doctoral degrees, then it may not be internal differences in commitment which determine further advancement. Rather, beyond this threshold of commitment needed to become faculty, it may be external differences in the environment which have greater influence on their further advancement.

In this study, both the term 'mentor' and the concept of mentoring were identified as being problematic for women faculty. There was a pervasive belief that a single person can provide all or most of the activities associated with mentoring. If there was not one individual who had provided extensive support for the career advancement of an individual, then she did not consider herself as having been mentored. Additionally, due to perceived power differentials between senior male faculty and junior female faculty, the women interviewed for this study saw mentoring as something which should be offered to them and not something which they should have to request.

As pointed out by Sonnert and Holton (1995), the social science literature, which addresses the underrepresentation of women as faculty in the sciences and engineering, locates the crucial variables as being either internal gender differences or external environmental deficits. This study found no internal career commitment difference, between women faculty in science and engineering and those in disciplines where women are already well represented, which would explain the underrepresentation of women in science and engineering. So why are women still underrepresented in science and engineering? Are there factors associated with the environment of these disciplines which "turn women off" to science and engineering?

The results of this study suggest that it is an external lack of acceptance and respect for women in the traditionally male identity academic discipline environments, and not an internal lack of female career commitment, which makes these careers more difficult for women and contributes to the underrepresentation of women faculty in science and engineering. Women science and engineering faculty had significantly higher career commitment scores.

In addition, there appear to be work related negative critical incidents which can cause women to give up their pursuit of non-traditional careers in science and engineering at different periods during the life span of career development and advancement. Significantly more of the negative critical incidents reported by the women faculty in this study involved a male.

Significantly more of the women in science or engineering reported that for their jobs to be better for them as women, they needed more acceptance, more respect, and more women colleagues. They are newcomers in traditionally male disciplines where scientists and engineers have looked like and acted like men. They are seen as different, and find their academic credibility is undermined, not by their training or competence, but by the stereotypical expectations associated with their gender. Though this study does not measure the importance of acceptance and respect in the career choices made by women, it is strongly suspected that these are significant factors.

Practice: One woman in this study reported that when she was the first new woman faculty member in her department, the male faculty encouraged her to participate in social activities with their wives. She said they did not know how to interact with her as a colleague. Another woman scientist reported that she got tired of being the only woman in her department year after year. She kept telling her male colleagues how difficult it was being so isolated, but they just did not hear her or understand what she was saying. She left her faculty position at the university to take a position with a medical school, in order to work in an environment where she could interact with more women faculty and professionals. These reported experiences of isolation point out the importance of a critical mass, and the need for faculty mentoring to provide support for female faculty, especially in the science and engineering disciplines where women are underrepresented.

One male senior faculty/administrator who was interviewed for this study was asked how he decides if he will mentor an incoming junior faculty member. He reported that the individual has to come to him and make the request and convince him that they are serious, enough so that he considers the effort to be worthwhile. If this asking and convincing of male mentors is being done by junior male faculty and not by junior female faculty, then some education of senior male faculty mentors and female junior faculty would be needed to get them both to see what has not been working. In identifying mentoring actions, the women in this study actually said that a mentor "offered to help." Junior women faculty may need to learn to ask for mentoring if it is not offered, and male mentors may need to realize that there are women who need guidance, but do not know how to ask for it.

Many quite different mentoring activities were identified by the women in this study and seen by them as being the helpful things a mentor does. If junior women faculty are expecting one individual to provide all these for them and if no individual can provide that level of support, then the mentoring expectations of women faculty will not be met. Educating junior faculty to expect research advice from one colleague, teaching from another, publication from a third, personal support from a fourth, etc., may help women to revise their expectations and identify a more realistic way that mentoring can work for them.

Perhaps the expectation of the women interviewed, that one person could provide all the mentoring for them, was a carry over from their graduate student experiences with a major professor or dissertation director. Several survey responses mentioned that the major professor had been a mentor. Or, perhaps the expectation of how a mentor takes you "under his wing" is a woman's interpretation based on her understanding of parenting. These women said they thought mentors "were thoughtful and caring, believed in them, helped them to grow, parented."

Educating junior women faculty about how to succeed in higher education might include helping the women to see that, in practice, mentoring may not be like parenting or a continuation of the major professor relationship. Mentoring can come from many people, and not just one. To be successful, they will probably have to learn to ask for what they need from senior male faculty and administrators, even if that is difficult for them. Departmental, college-wide, or university-wide orientations for new faculty might be an excellent way to present this topic for discussion.

The many and varied mentoring activities these women reported as helpful to their career advancement were grouped into four areas. These areas of activity are identified as: 'Supportive,' 'Skill Development,' 'Promotion,' or 'Guidance.' The women could give more examples of the Supportive and Skill Development mentoring activities, but they thought Promotion and Guidance activities were especially important to the success of their career advancement in higher education. These responses regarding helpful actions could be used to educate senior male faculty about the mentoring expectations of incoming junior women faculty, especially in those academic disciplines in which women are underrepresented and being recruited as new faculty.

In the academic disciplines where women are underrepresented as faculty, it may be especially important to define mentoring roles and responsibilities as part of orientation, and to identify a pool of potential senior male faculty mentors from which incoming junior women faculty can chose. Orientation could be used to identify more workable mentoring concepts, and to get junior women faculty the support they need early in their careers.

The widely-held belief that, in practice, only women can serve as role models and mentor other women may be a roadblock to progress for women in disciplines where they are underrepresented. This study found no difference in career commitment between women faculty who received more mentoring from men, and women faculty who received more mentoring from women. There are more men in the non-traditional science and engineering academic disciplines, and it would seem reasonable that it is men who, being more established in science and engineering, are more numerically available to serve as mentors to women students and faculty. Departmental, college, and university-wide encouragement, incentives, and mentoring "how-to" training for male faculty in science and engineering and any other academic discipline where women have not achieved critical mass as tenure-track faculty, could be used to identify potential male mentors for women.

Among the less mentored women in this study, the women who had been less mentored by men scored higher in career commitment than the women who had been less mentored by other women. In those academic disciplines and departments where there are few senior women faculty, it may be especially important that incoming junior women are not assigned to a woman mentor, especially if the woman mentor is already overloaded and does not have the time, energy, or ability to mentor. The skill and availability of the mentor may be more important to the career advancement of junior women faculty than the mentor's gender.

Future Research: It is possible that junior women faculty have differing expectations about the mentoring they will receive from men and women. When a man mentors less, it may not be as disappointing to women as it is when a woman mentors less. Women may expect women to mentor them more, and when that does not happen with a female mentor, then their expectation may not be met, and they may be disappointed. Women may expect men to mentor them less, and when a male mentor neglects them, then their expectation has been met. Since the women who were less mentored by men in our study had higher career commitment scores, it would seem that the women who were less mentored by men were not as disappointed, and may have reacted with more determination and more career commitment. This warrants further study.

The women faculty in this study reported that there were critical incidents which had an impact on their careers in higher education. When women react negatively to a critical career incident, then the impact upon their career can be negative. When women are able to recover and react positively to a critical incident, then they may be able to continue in their career, and in some cases may become more determined to succeed. More research is needed to determine the role of critical incidents and negative reactions in the underrepresentation of women in science and engineering faculty careers.

The women science and engineering faculty in this study had significantly higher career commitment scores than women faculty in other academic disciplines. These women also had concerns about their jobs which differed significantly from the concerns of women in other disciplines. The science and engineering faculty said they needed more acceptance, more respect, and more female colleagues, for their jobs to be better for them as women. Acceptance and respect were not concerns for the women in disciplines where women are advancing successfully and have achieved a critical mass. These findings raise questions about the work environment within the physical sciences and engineering, and point to the need for additional study to identify changes which could be made in the science and engineering work environment, to encourage and support women in advancing and achieving a critical mass in these non-traditional academic careers.

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APPENDIX

Cover Letter Sent with Survey

(Return Address)
(date)

(Inside Address)

Dear Dr. ________:

As a woman faculty member, you know there are some academic disciplines where women are well represented as faculty, and other disciplines where women faculty are still quite rare. The enclosed survey is concerned with identifying factors which contribute to the career advancement of women faculty in different disciplines in higher education. The data collected from this study will be used in my doctoral research for Louisiana State University.

Your participation in this study is especially crucial to the results because the sample for this study is small. Participants have been carefully selected by academic discipline, and what you contribute will provide important information on the career advancement experience of women in the academic discipline you represent. The survey instrument has been designed to obtain all necessary data, while requiring a minimum of your time.

It will be greatly appreciated if you can complete the survey prior to (date), and return it in the stamped envelope enclosed. Any comments you may have concerning factors which impact the career advancement of women faculty, not covered in the instrument, are most welcome.

Please be assured that all your responses will be held in strictest confidence. Thank you for your cooperation.

Sincerely yours,

(name)
Doctoral Candidate
(phone number)
(e-mail address)

Enclosures:
3 page survey & return envelope

Women Faculty Career Advancement Study

1. What is your highest degree, & in what academic discipline did you receive this degree? degree ____________________ discipline ____________________

2. From what institution did you obtain your doctorate (or terminal degree), and in what year? institution _______________ year _______________

3. How many years have you been employed as a faculty member at this university? ________ elsewhere? __________

4. In what academic department and college are you currently employed? department _________________ college ___________________________

5. How many faculty are in your department of employment? total faculty ______ How many female faculty? female faculty ______

6. What is your current faculty rank (i.e. assistant, associate, full)? __________

7. Are you in a full-time or a part-time position? ______________________

8. What percentage of your time is spent on teaching? _____ research? _____ other? (please specify what other is)

9. How many refereed publications have you authored or co-authored? ____________

10. On how many committees (department, college or university-wide) do you serve? ________

11. If you have extramural funding, how many grants or contracts have you received? ________

    What is the approximate total amount of your extramural funding to date? $_____

12. Is there a written promotion and tenure policy for your department? ___________

13. Do you or did you understand what was required for you to achieve tenure? _____

14. Do you have tenure? _______ If so, in what year were you tenured? 19 _____

15. What would you like to be doing 10 years from now?
(Use back of page 1 if needed) ____________________________________

16. If you could change only one thing about your job, to make it better for you as a woman, what would it be? ____

Please respond to the following statements with a number:
(1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree)

_____ 17. My central life interests lie outside of my job at the university.

_____ 18. My main interests in life are closely related to my job in the university.

_____ 19. When I am worried, it is usually about things related to my job.

_____ 20. I believe that other things are more important than my job at the university.

_____ 21. Most of my energy is directed toward my job.

_____ 22. In talking to friends, I most like to talk about events related to my job.

_____ 23. My central concerns are job related.

_____ 24. The working environment in my academic department is mostly competitive.

_____ 25. The working environment in my department is mostly cooperative & supportive.

_____ 26. My academic department offers opportunities for me to advance and be rewarded.

27. Please reflect on whether or not someone has been helpful to you in your academic career. This could have included advice, encouragement, funding, introductions, teaching you the rules, or anything you consider supportive of your career. Has anyone done this for you?

If you can identify anyone who has been helpful to your career, please specify this person's:

role or position title __________________ sex ________ race __________

(Use back of page, or attach a separate page to explain how this person was helpful.)

Please respond to the following statements with a number:
(1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree)

_____ 28. People within my academic department have been helpful to my career.

_____ 29. Others in this university, but outside my academic department, have been helpful.

_____ 30. Others in academia, outside this university, have been helpful to my career.

_____ 31. Family, friends, or peers have encouraged me and been supportive of my career.

_____ 32. Teachers or supervisors have advised me or given me encouragement for my career.

_____ 33. Women have advised or encouraged me and been supportive of my career.

_____ 34. Men have advised or encouraged me and been supportive of my career.

35. Please reflect and recall some significant experience you have had in the past which has had an impact on your career. You may have considered this experience to be positive and empowering or negative and difficult. Please describe this incident and explain how you think it affected your career. (Use the back of this page or attach a separate page if needed.)

36. What is your age? _____

37. What is your race or ethnic background? ______________________

38. Are you married? _____

39. If you have children, what are the ages of your children? ___________________

40. May I contact you if I have another question? _____ Phone ____________
Your e-mail address __________________________

Thank you for your participation in this research.

Please return this survey to: (name & address, phone number & e-mail address)

VITA

Gloria Nye was born in Indiana, and she has lived in California, Delaware, Florida, Illinois, Louisiana, Massachusetts, and Nevada. She attended public elementary schools in Indiana, Illinois and Florida, and graduated Dean's List from McArthur High School in West Hollywood, Florida. Gloria earned undergraduate credit at Stetson University, University of Florida, Santa Rosa Community College, and Allan Hancock College in California, where she obtained an associate of arts degree. Her bachelor of arts degree is from Sonoma State University in California, where she majored in economics. Gloria's master of science degree in family economics and consumer education is from Purdue University, where she also became a licensed airplane pilot. Her doctor of philosophy degree in educational leadership and research was earned at Louisiana State University, in 1997.

In thirteen years at Purdue, Gloria Nye was a conference coordinator in Continuing Education, and the academic business administrator for both the Laboratory for Applications of Remote Sensing and the School of Electrical Engineering. At the University of Nevada-Reno, Gloria was Assistant Dean for Research Development for the College of Engineering. For eight years at Louisiana State University, Gloria was first the assistant to the chairman of the Biochemistry Department, and then became the Coordinator for Research and Development for the Center for Energy Studies. Gloria has served as president, and on the board of directors for numerous organizations, including Phi Delta Kappa, Head Start and Planned Parenthood. She also served as Executive Director of the Greater Lafayette, Indiana Community Centers for two years.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Gloria Tara Nye

Major Field: Educational Leadership and Research

Title of Dissertation:

Academic Discipline, Mentoring, and the Career Commitment of Women Faculty

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

June 30, 1997